From DDD to Delivery

Daniel Hinojosa

Understanding why DDD is the cornerstone of everything

In this Presentation

- What is Domain Driven Design
- Subdomains
- Ubiquitous Language
- Bounded Context
- Integrating Bounded Contexts
- Simple Applications
- Complex Applications
- Event Storming

Slides and Material: https://github.com/dhinojosa/from-ddd-to-delivery

What is DDD?

What is Domain Driven Design?

- Domain Driven Design (DDD) is a set of tools that assist you in designing and implementing software that delivers high value, both strategically and tactically
- DDD focus your attention on what your company or your team should be focused on
- DDD has a strategic value in about mapping business domain concepts into software artifacts.
- DDD is about organizing code artifacts in alignment with business problems, using the same common, ubiquitous language
- DDD is about taking this business language, the ubiquitous language and creating models that represent the language and used to solve problems

Advantages & Disadvantages

- Incremental & Flexible
- Organized: In code and teams
- Focuses on the Domain
- Learning Curve
- Time and Effort

Two Parts of DDD

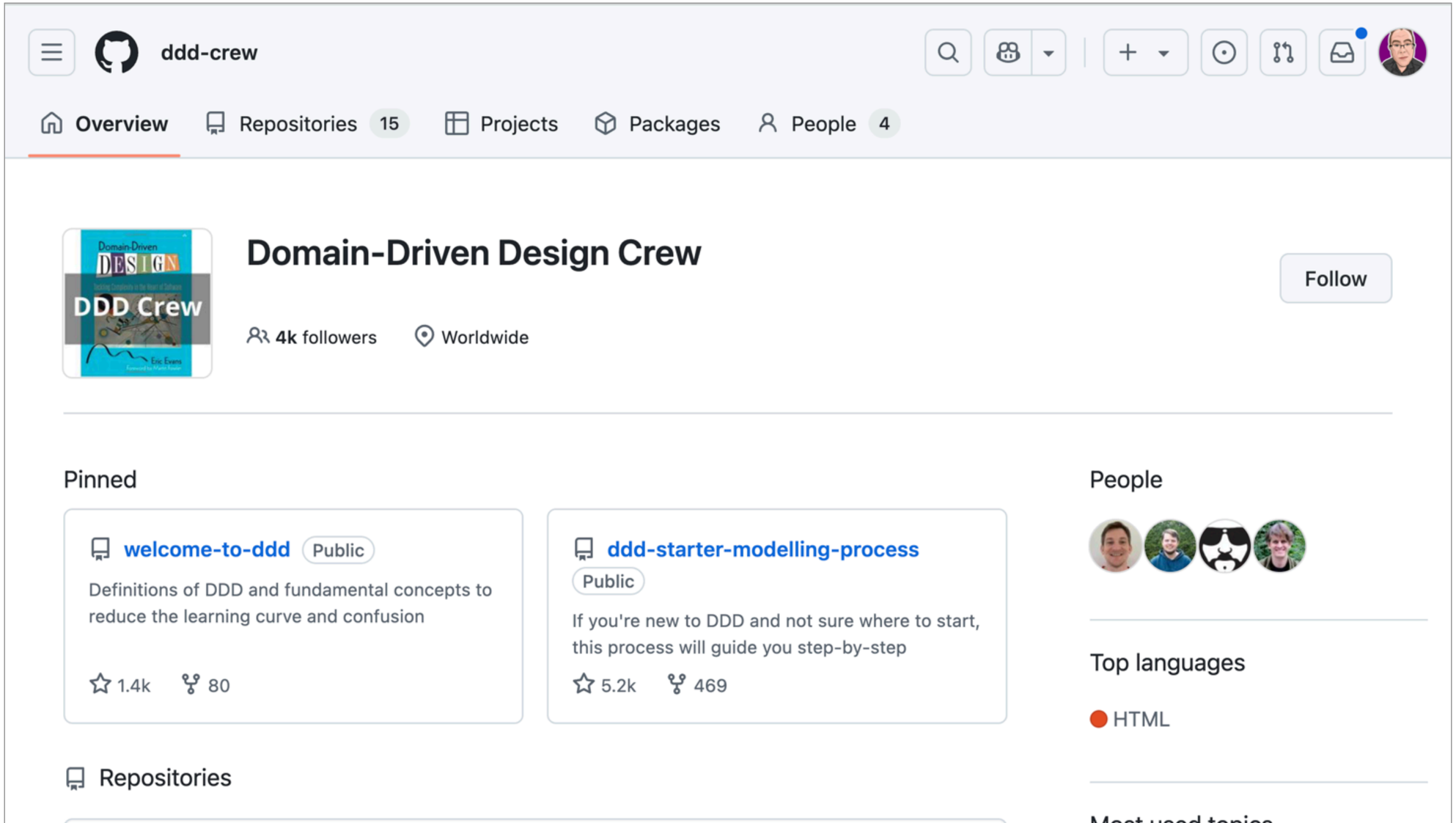
Strategic

Tactical

When do I not use DDD?

- Very simple projects where the domain is one to maybe ten different models. It might be overkill to use DDD
- Regardless, thinking about domains and models is essential even if you and your team are not going through the entire DDD process
- If you are in a large company, with many business roles, then DDD will give benefit and clarity
- In the end, it depends, but you will find many aspects of DDD helpful in the large

https://github.com/ddd-crew



Subdomains [Strategic]

Business Domain

- Defines a company’s main area of activity, it’s primary business.
- Generally speaking, it’s the service the company provides to its clients.
- Examples include:
  - FedEx provides courier delivery.
  - Starbucks is best known for its coffee.
  - Walmart is one of the most widely recognized retail establishments

Ancillary Domains

- A company can operate in multiple business domains.
- For example:
  - Amazon provides both retail and cloud computing services.
  - Uber is a rideshare company that also provides food delivery and bicycle-sharing services.
- It’s important to note that companies may change their business domains often!

Subdomains

- For a business domain’s goals and targets, a company has to operate in multiple subdomains
- A subdomain is a fine-grained area of business activity
- All of a company’s subdomains form its business domain: the service it provides to its customers
- The subdomains have to interact with each other to achieve the company’s goals in its business domain

Real World Subdomains

- Starbucks may be most recognized for its coffee
- The successful coffeehouse chain requires more than just knowing how to make great coffee.
- It also includes:
  - How to buy or rent real estate at effective locations
  - Hire personnel
  - Manage finances
  - Other activities

Three Types of Subdomains

Core

Generic

Supporting

Core Subdomain

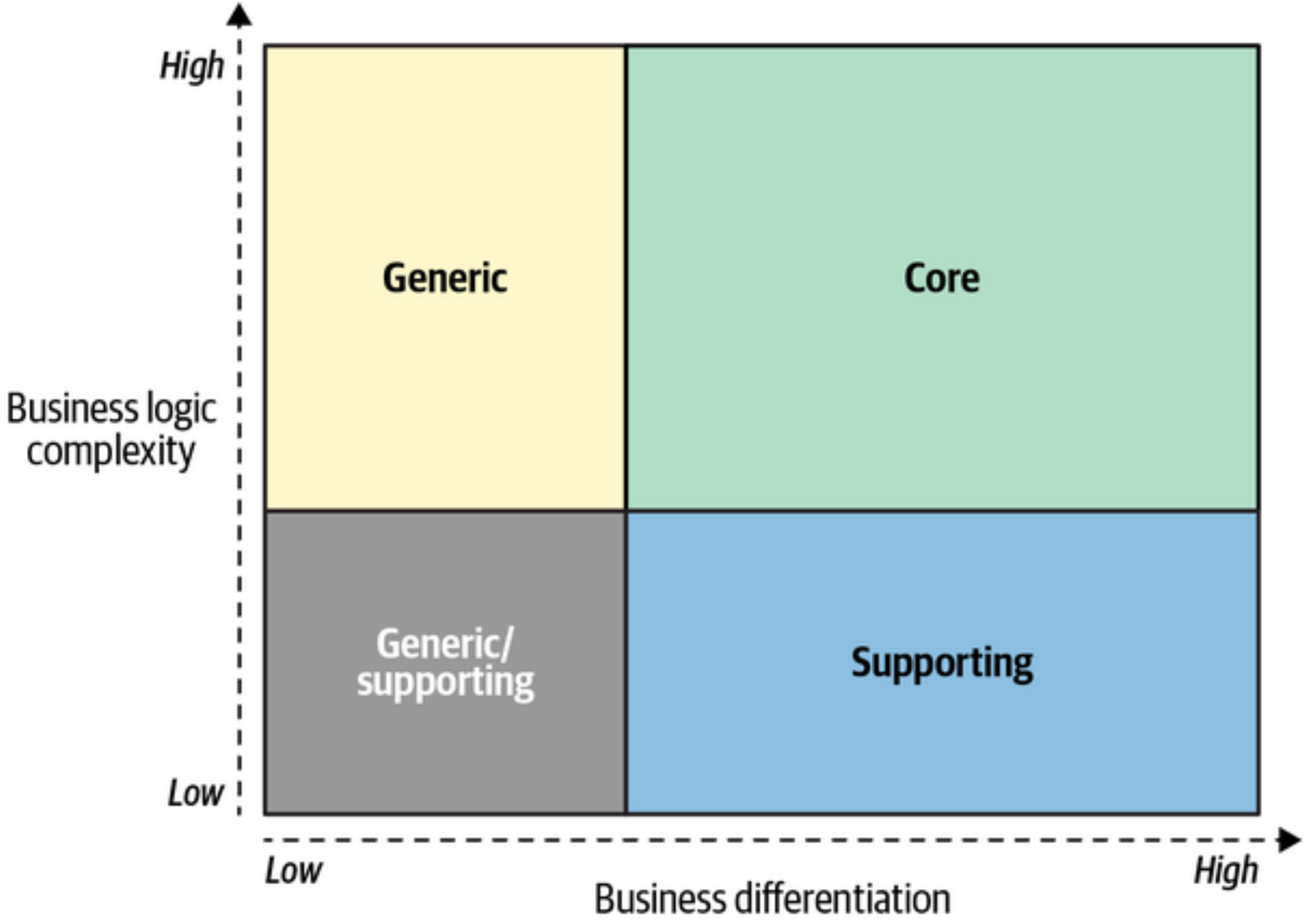
- A core subdomain is what a company does differently from its competitors
  - "Inventing new products or services"
  - "Reducing costs by optimizing existing processes"
  - "Ship products to hard-to-reach locations”
- Must be complex and hard for competitors to mimic
- It doesn’t have to be technical

Generic Subdomain

- Generic subdomains are business activities that all companies are performing in the same way.
- Like core subdomains, generic subdomains are generally complex and hard to implement.
- However, generic subdomains do not provide any competitive edge for the company.
- There is no need for innovation or optimization here: battle-tested implementations are widely available, and all companies use them.
- e.g. Authenticating Users, Securing Networks, Organizing your Day, etc.

Supporting Subdomain

- Supporting subdomains support the company’s business.
- However, contrary to core subdomains, supporting subdomains do not provide any competitive advantage.
- Business logic resembles ETL (extract, transform, load) operations; that is, the so-called CRUD (create, read, update, and delete) interfaces.
- These activity areas do not provide any competitive advantage for the company, and therefore do not require high entry barriers.



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Subdomain type	Competitive advantage	Complexity	Volatility	Implementation	Problem
Core	Yes	High	High	In-house	Interesting
Generic	No	High	Low	Buy/adopt	Solved
Supporting	No	Low	Low	In-house/outsource	Obvious

Identifying Domain Experts [Strategic]

Domain Experts

- Domain experts are:
  - Subject-matter experts who know all the intricacies of the business that we are going to model and implement in code.
  - Knowledge authorities in the software's business domain
- Domain experts are not:
  - The analysts gathering the requirements
  - The engineers designing the system

Domain Expert Scope

- Some subject-matter experts will have a detailed understanding of how the entire business domain operates
- Others will specialize in particular subdomains

Ubiquitous Language [Strategic]


¡THREE AMIGOS!
Developer
Tester
Product Owner

Ubiquitous Language

- Cornerstone of Domain Driven Design
- A dictionary of the same language
- A language for describing your business domain
- Represents both the business domain and the domain experts' mental models.

Ubiquitous Language Goals

- Represent the companies terms only
- No technical jargon (e.g. RestFUL, Patterns, Kubernetes)
- Frame the domain experts' understanding and mental model
- Make it easy to understand and eliminate assumptions

Consistency

- Each term of the *Ubiquitous Language* should have only one meaning
- If it doesn’t it may fall into one of the following categories:
  - Ambiguous Terms
  - Synonymous Terms

Ambiguous Terms

- Example: In business domain, the term policy has multiple meanings:
  - A regulatory rule
  - An insurance contract
- Ubiquitous language demands a single meaning for each term
- “policy” should be modeled explicitly using the two terms regulatory rule and insurance contract

Synonymous Terms

- Two terms cannot be used interchangeably in a ubiquitous language
- Example: user
- User may be used interchangeably: user, visitor, administrator, account, etc.

Ubiquitous Language in Artifacts

- Ubiquitous Language should be used in
  - Requirements
  - Tests
  - Documentation
  - Source Code
- Of course, it should match the language of the business
- Make it a centerpiece and include a source of truth glossary

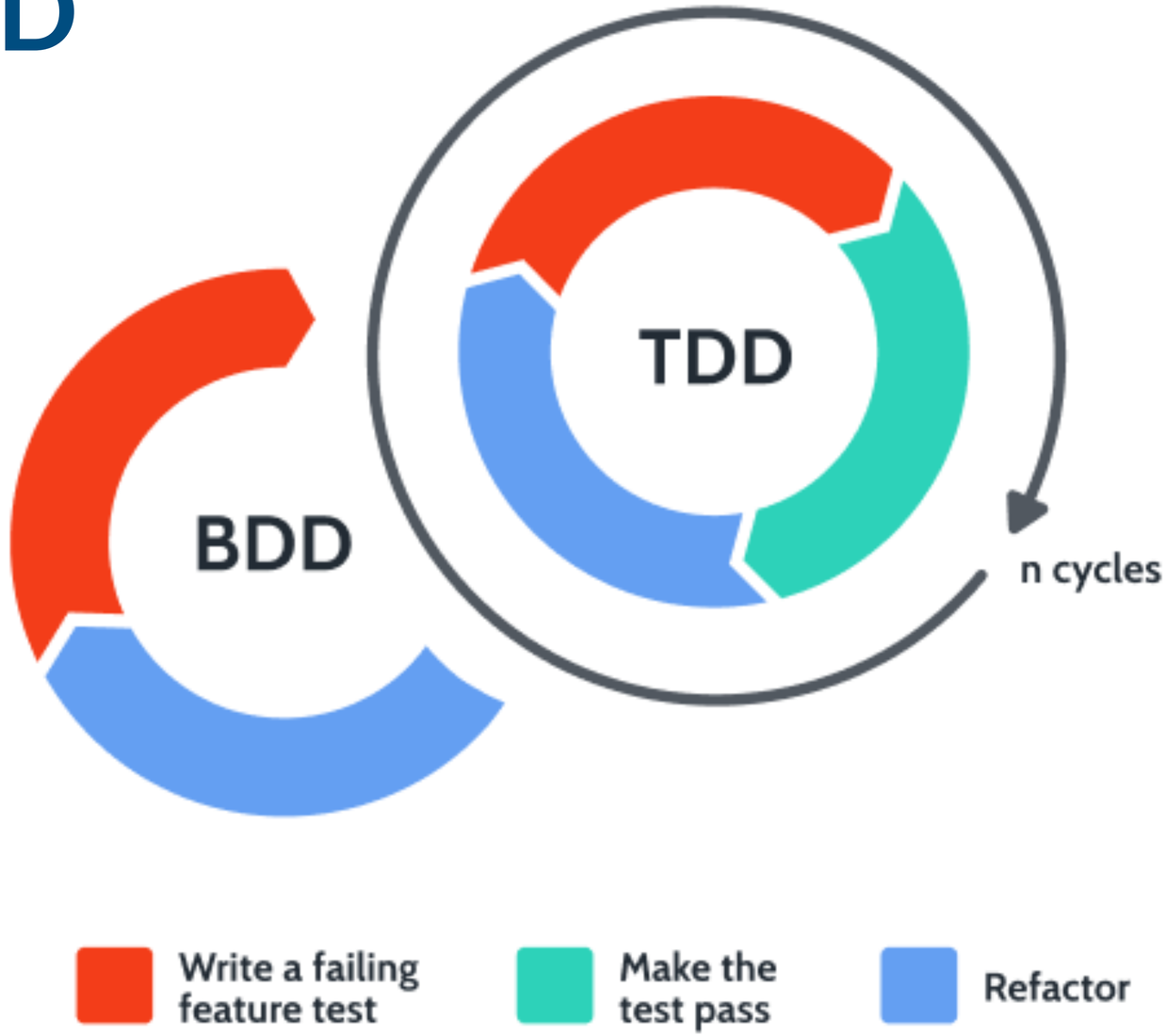
Gherkin and BDD

```
Given the account has a balance of $23.95
When a message of "balance" comes in from a 404-333-2222
Then a text is sent back: "Your balance is $23.95"

Given the account has a balance of $23.95
When any message comes in from an unknown number 233-123-1121
Then log message and phone number, and do nothing

Given the account has a balance of $23.95
When any message other than "balance" comes in from a 404-333-2222
Then send text back: "Didn't understand message, send BALANCE for current balance."
```

BDD & TDD


TDD
BDD
n cycles
Write a failing feature test
Make the test pass
Refactor

Bounded Contexts [Strategic]

Inconsistent Models

- Ubiquitous Language should be consistent since it will drive decisions
- As companies scale, the domain experts' mental models will be inconsistent
- Domain experts will use synonymous terms and ambiguous terms
- Some will be hard to detect after initial assessment
- `Lead`, `Sale`, `Account`, `Candidate`, `Order` - These are few terms that may have different meanings, albeit slight, depending on who you ask

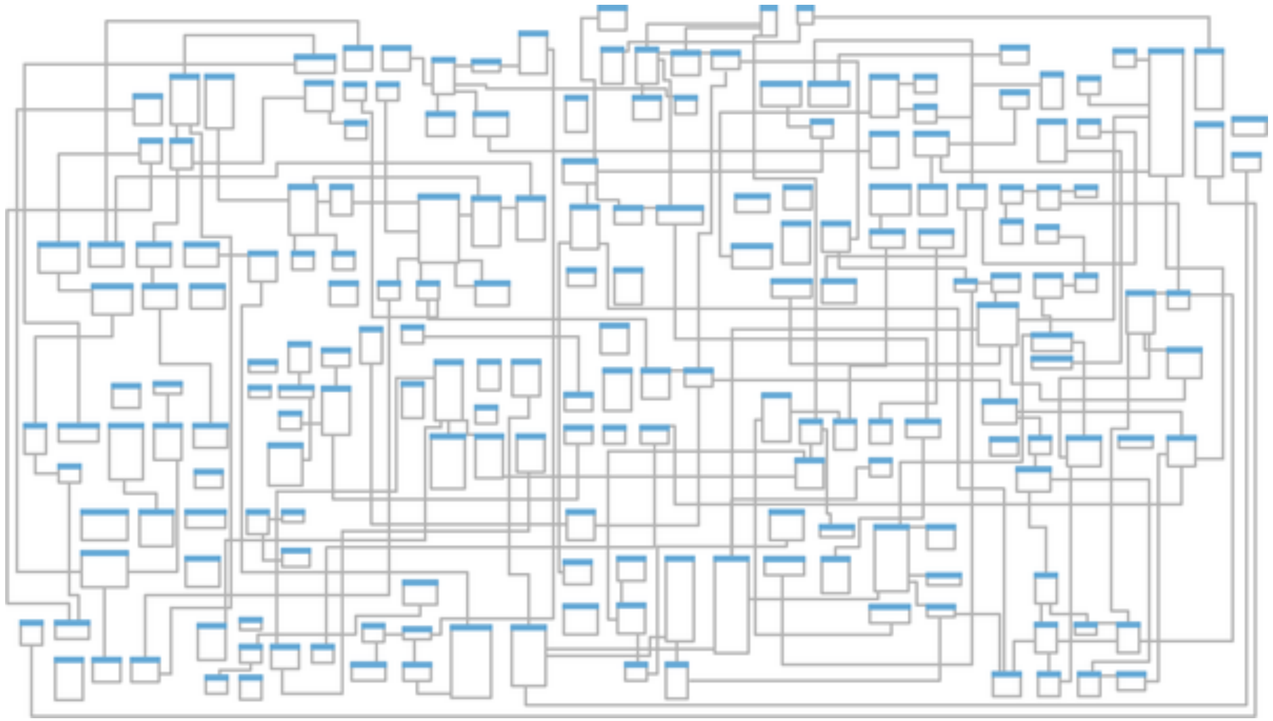

SANCHO
7
28
DANKE
KUMPEL

Dealing with Ambiguity

- Ubiquitous Language needs to be consistent - each term should have one meaning
- Ubiquitous Language needs to map to domain experts' mental models
- Having two `leads` isn’t a problem in communication, but it is in software

The Traditional Approach

- The Traditional Approach for such modeling a single model
- Typically defined by an enormous entity relationship (ERD)
- "Suitable for everything but eventually are effective for nothing"



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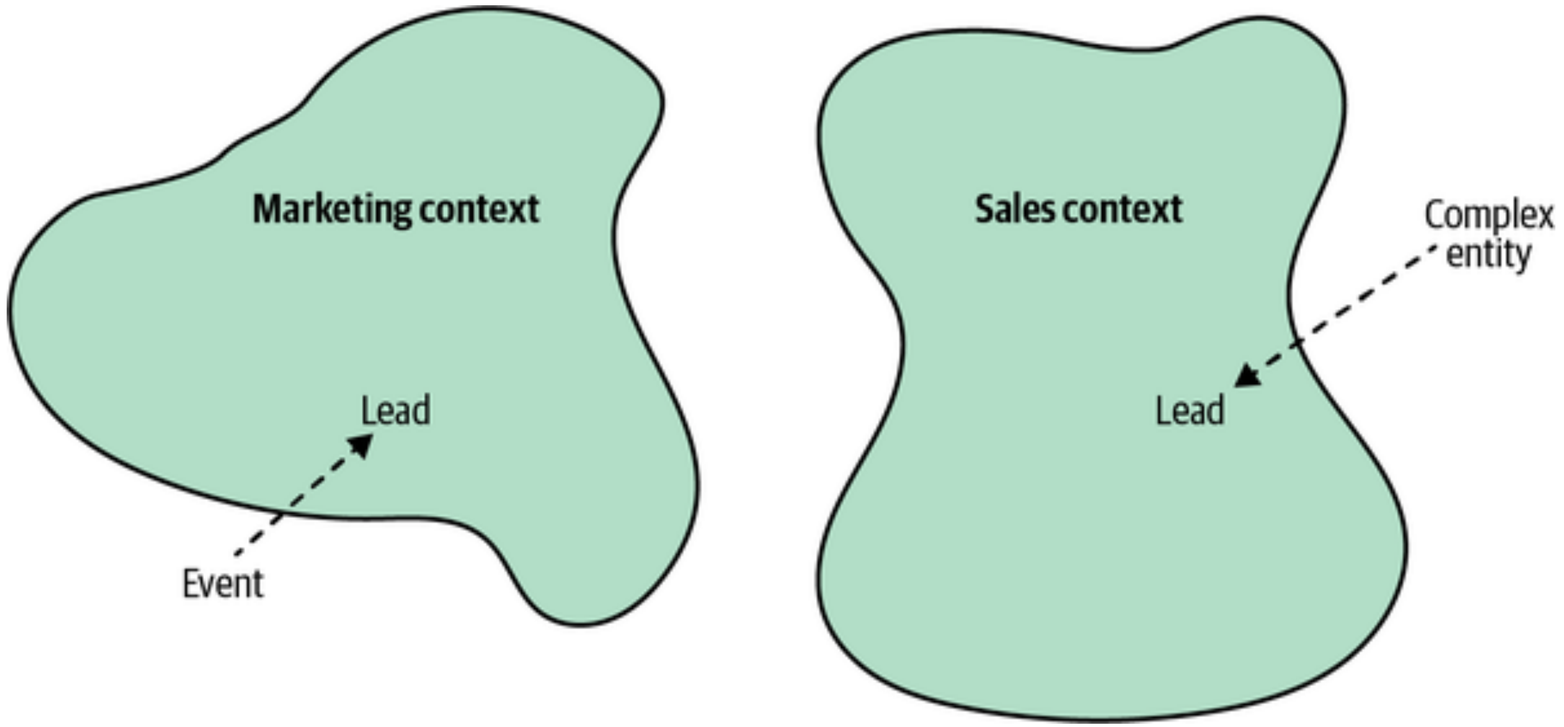
Would Prefixing Work?

- Can we do “marketing lead” and “sales lead"?
- Allows for two different models of code
- This has three main disadvantages:
  - Creates cognitive load. When should each be used? The closer they are the likely a mistake
  - The implementation will not be aligned with the ubiquitous languages
  - Does anyone use the prefixed terms in everyday language?

Bounded Contexts

- Divide the Ubiquitous Language into multiple smaller languages
- Assign each team to the explicit context in which it can be applied: *its bounded context*



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The Bronx
Van Cortlandt Park
2
Wakefield-241 St
Wakefield
5
Nereid Av
233 St
225 St
219 St
Gun Hill Rd
Burke Av
Allerton Av
Pelham Pkwy
Bronx Park East
E 180 St
West Farms Sq-E Tremont Av
Eastchester-Dyre Av
Baychester Av
Morris Park
4
Woodlawn
Mosholu Pkwy
Bedford Pk Blvd-Lehman College
Kingsbridge Rd
Fordham Rd
183 St
Burnside Av
176 St
Mt Eden Av
Norwood 205 St
D
B
Bedford Pk Blvd
Tremont Av
182-183 Sts
174-175 Sts
Woodlawn
Williams Bridge
Botanical Garden
Bronx Park
Fordham
University Heights
Morris Heights

United States
Canada
United States
Mexico
Caribbean
Central America
Venezuela
Guyana
Suriname
French Guiana (France)
Colombia
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Argentina
Uruguay
PACIFIC OCEAN
ATLANTIC OCEAN
ATLANTIC OCEAN
Iceland
Ireland
U.K.
Portugal
Spain
France
Italy
Greece
Norway
Sweden
Finland
Estonia
Latvia
Lithuania
Belarus
Ukraine
Poland
Germany
Romania
Turkey
Cyprus
Lebanon
Israel
Iraq
Syria
Jordan
Saudi Arabia
U.A.E.
Yemen
Oman
Kuwait
Qatar
Iran
Afghanistan
Pakistan
Kazakhstan
Uzbekistan
Turkmenistan
Kyrgyzstan
Tajikistan
Mongolia
China
Nepal
Bhutan
India
Bangladesh
Sri Lanka
Laos
Vietnam
Thailand
Cambodia
Malaysia
Indonesia
Philippines
Taiwan
N. Korea
S. Korea
Japan
Russia
Western Sahara
Algeria
Tunisia
Libya
Egypt
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Djibouti
Ethiopia
Senegal
The Gambia
Guinea-bissau
Guinea
Sierra Leone
Liberia
Cote d'Ivoire
Ghana
Togo
Benin
Nigeria
Equatorial Guinea
Gabon
C.A.R.
Dem. Rep. of Congo
Uganda
Rwanda
Burundi
Tanzania
Kenya
Angola
Zambia
Zimbabwe
Namibia
Botswana
South Africa
Lesotho
eSwatini
Mozambique
Malawi
Madagascar
INDIAN OCEAN
Australia
Papua New Guinea
Timor-Leste

North Bergen
Secaucus
West New York
Union City
Weehawken
Hoboken
NEW

New Rochelle
Pelham Manor
Englewood
Hackensack
Lodi
Hasbrouck Heights
Ridgefield Park
Fort Lee
Teterboro Airport
Ridgefield
Cliffside Park
Fairview
North Bergen
Secaucus
Guttenberg
Union City
Weehawken
Hoboken
Manorhaven
Port Wa
Great Neck
Great Neck Plaza
City of New York

Ubiquitous Language is not universal

- One bounded context can be completely irrelevant to the scope of another
- They allow distinct models according to different problem domains
- Bounded contexts are the consistency boundaries of ubiquitous language

How big should the bounded context be?

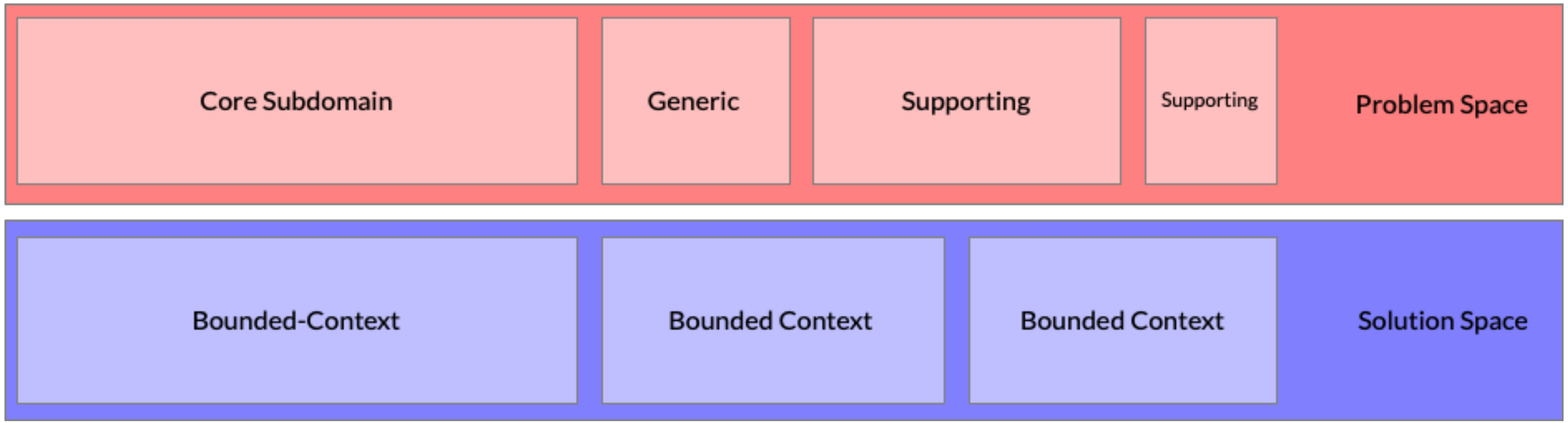
- It should be useful and based on your problem domain
- The wider the boundary of the ubiquitous language is, the harder it is to keep it consistent.
- The smaller the boundary of the ubiquitous language, the more integration overhead the design induces

Bounded Context vs Subdomains

- Subdomains
  - Recall identification of different subdomains: core, supporting, generic
  - Subdomains are interrelated use-cases and defined by the business domain and system requirements
- Bounded Contexts
  - Designed - A strategic designed decision
  - We decide how to divide the business domain into smaller, manageable problem domains

Bounded Context vs Subdomains

- Subdomains are part of the **problem space** - "What is in place and what are we solving"
- Bounded Contexts are part of the **solution space** - "How do we solve the problems"



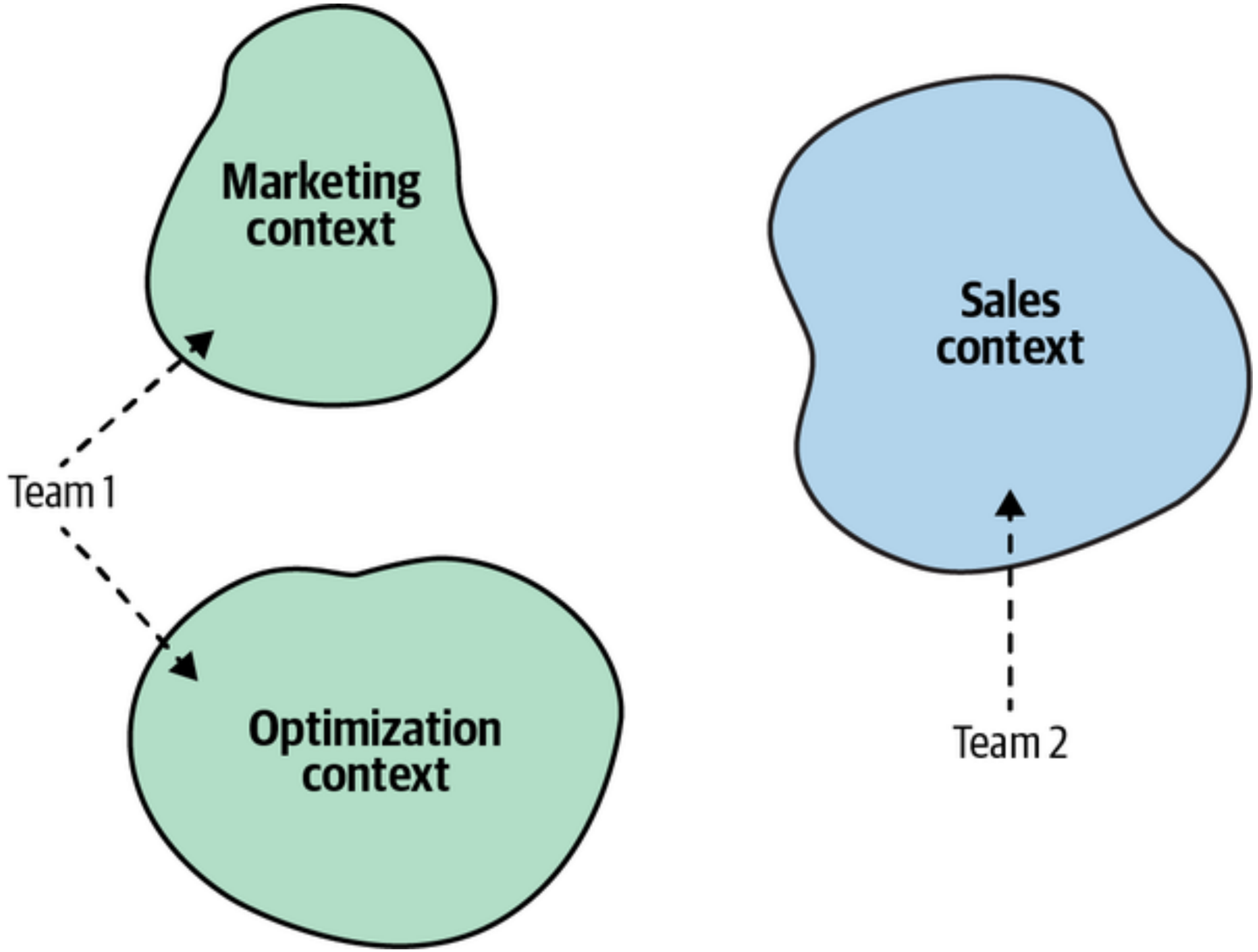
Physical and Ownership Boundaries

Physical Boundary

- Each bounded context should be implemented as an individual service/project
- It is implemented, evolved, and versioned independently of other bounded contexts
- Clear physical boundaries between bounded contexts allow us to implement each bounded context with the technology stack that best fits its needs
- A bounded context can contain multiple subdomains. In such a case, the bounded context is a physical boundary, each of its subdomains is a logical boundary
- Logical boundaries bear different names in different programming languages: **namespaces, modules, or packages.**

Ownership Boundary

- A bounded context should be implemented, evolved, and maintained by one team only
- No two teams can work on the same bounded context
- Segregation eliminates implicit assumptions that teams might make about one another's models



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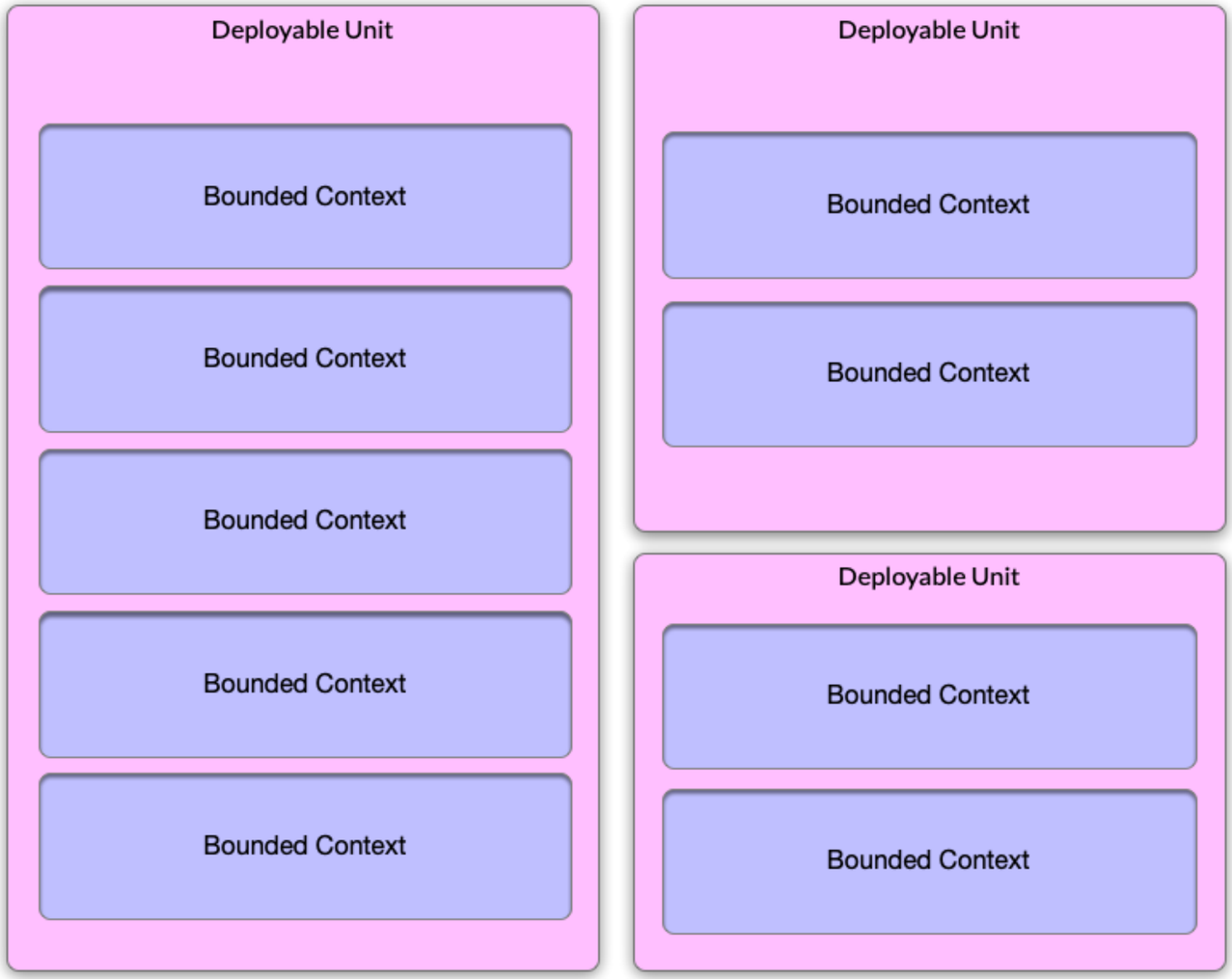
Microservices and Bounded Contexts

- Controversial Topic. Yes, it is. Take some time to look at varying opinions.
- Microservices came out in 2011, Bounded Contexts came out in 2003.
- But they are a compliment. Remember the rules in the previous slide on physical and ownership boundaries

Microservices and Bounded Contexts

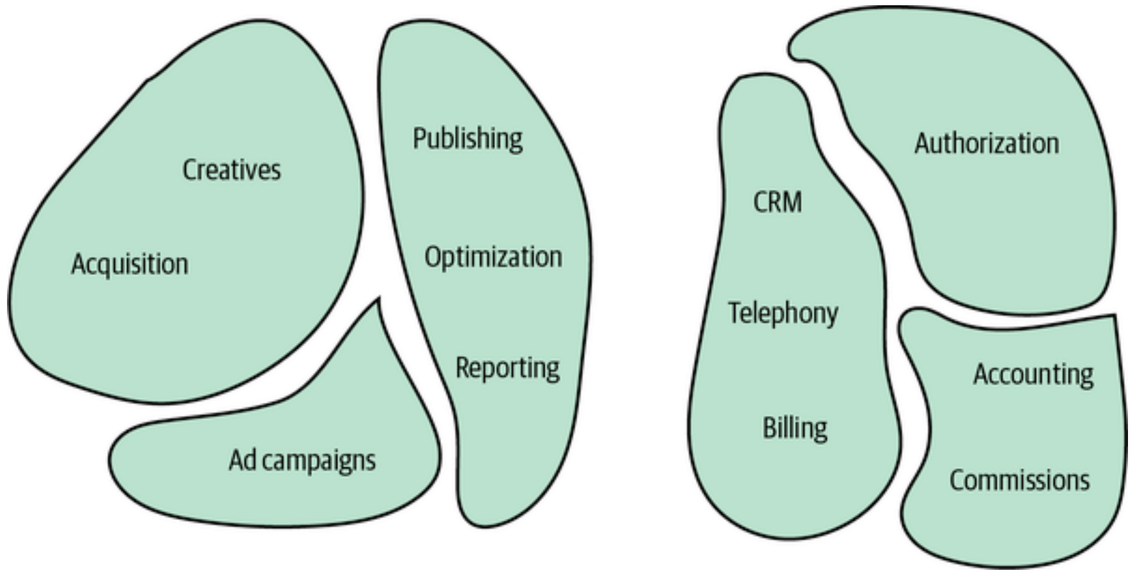
- **A Bounded Context is a Conceptual Boundary:**
  - It ensures that a specific domain model has clear meaning within its boundary.
  - It’s about creating language and modeling consistency.
- **A Microservice is a Deployment Unit:**
  - It’s a technical implementation detail that allows independent deployment, scaling, and evolution.

Microservices and Bounded Contexts



The Diagram

Contexts are neither big nor small, but useful



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Integrating Bounded Contexts [Strategic]

Contracts

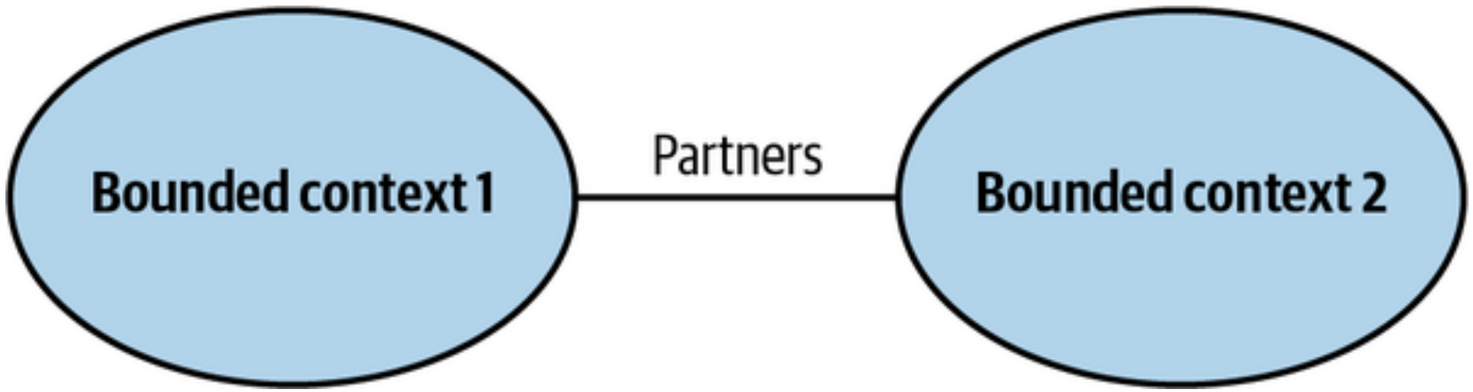
- A system cannot be built out of independent components, the components have to interact with one another to achieve the system's overarching goals
- The same goes for implementations in bounded contexts.
- Although they can evolve independently, they have to integrate with one another
- These are called *contracts*

Contracts Between Contracts

- By definition, two bounded contexts are using different ubiquitous languages.
- Which language will be used for integration purposes?
- These integration concerns should be evaluated and addressed

Partnership

- Integration between bounded contexts is coordinated in an ad hoc manner
- One team can notify a second team about a change in the API, and the second team will cooperate and adapt—no drama or conflicts



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Partnership Coordination

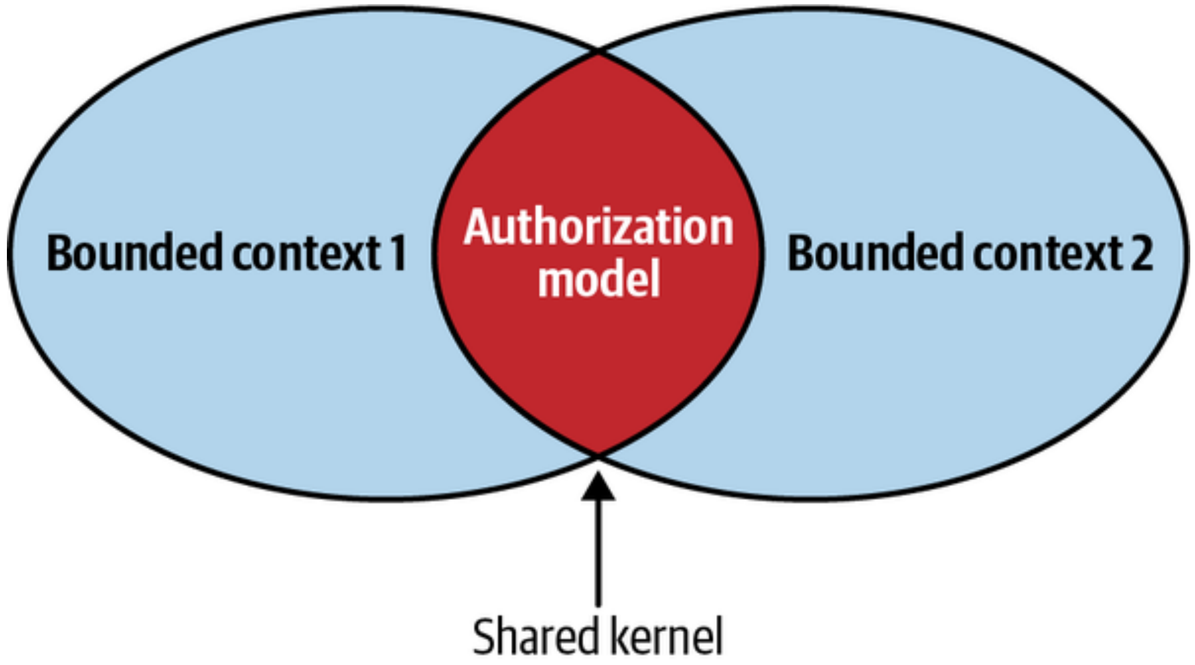
- Coordination is two-way
- No one team dictates the language that is used for defining the contracts
- Teams work out the differences and choose the most appropriate solution
- Both cooperate, and neither is interest in blocking another

Partnership Requirements

- Commitment
- Constant Communication
- Continuous Integration to minimize the integration feedback loop
- Both teams should highly likely be geographically in the same location

Shared Kernel/Model

- Same model of a subdomain, or a part of it, implemented in multiple bounded contexts
- Designed according to the needs of all of the bounded contexts
- Consistent across all of the bounded contexts that are using it



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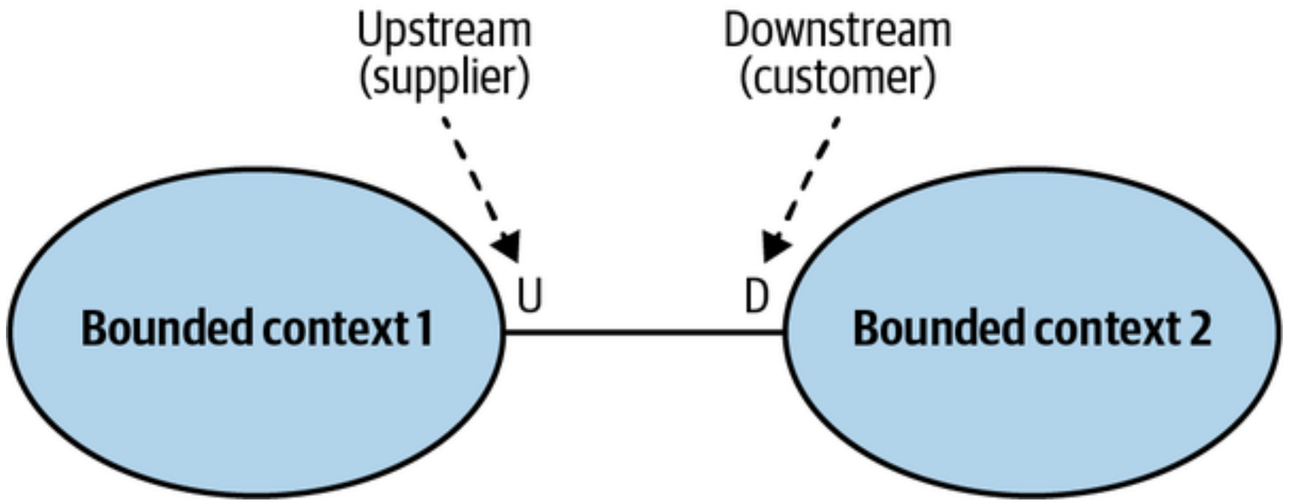
Shared Kernel/Model

- Example: Custom Authentication/Authorization module used by separate bounded contexts
- Implemented as a mono-repo - sharing the same files per one repository
- Implemented as a dedicated-repo - dedicated project and referenced as a library
- Tight CI/CD
- ***Using a shared kernel violates the independence rule of bounded context, and therefore, should be justified***
- ***It can be used as migratory tool to either combine bounded contexts or split them apart***

Customer-Supplier

- The service provider is “upstream” and the customer or consumer is “downstream.”
- Both teams (upstream and downstream) can succeed independently
- Imbalance of power: either the upstream or the downstream team can dictate the integration contract
- This is where a decision should be made about the relationship



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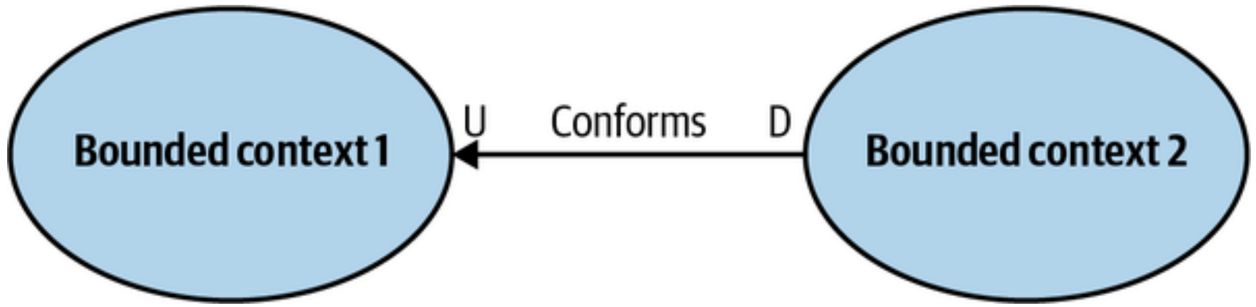
Conformist

- Balance of power favors the upstream team, no real motivation to support the client
- Upstream provides the integration contract, defined according to its own model—take it or leave it
- Caused by integration with service providers that are external to the organization or simply by organizational politics
- The contract exposed by the upstream team may be an industry-standard, well-established model, or it may just be good enough for the downstream team's needs.



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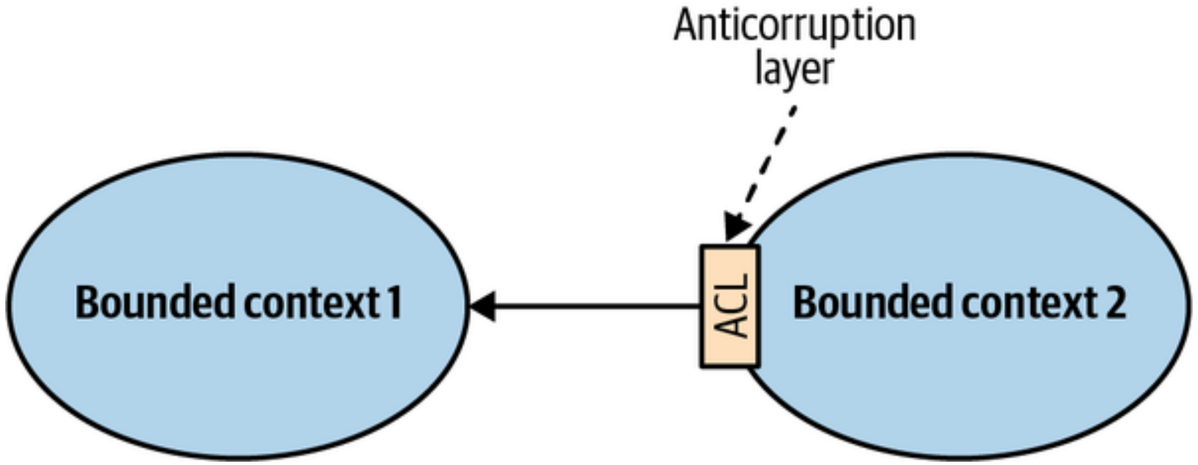
Anti-Corruption Layer

- The balance of power in this relationship is still skewed toward the upstream service.
- In this case, the downstream bounded context is not willing to conform.
- Instead, it translates the upstream bounded context's model into a model tailored to its own needs via an anticorruption layer



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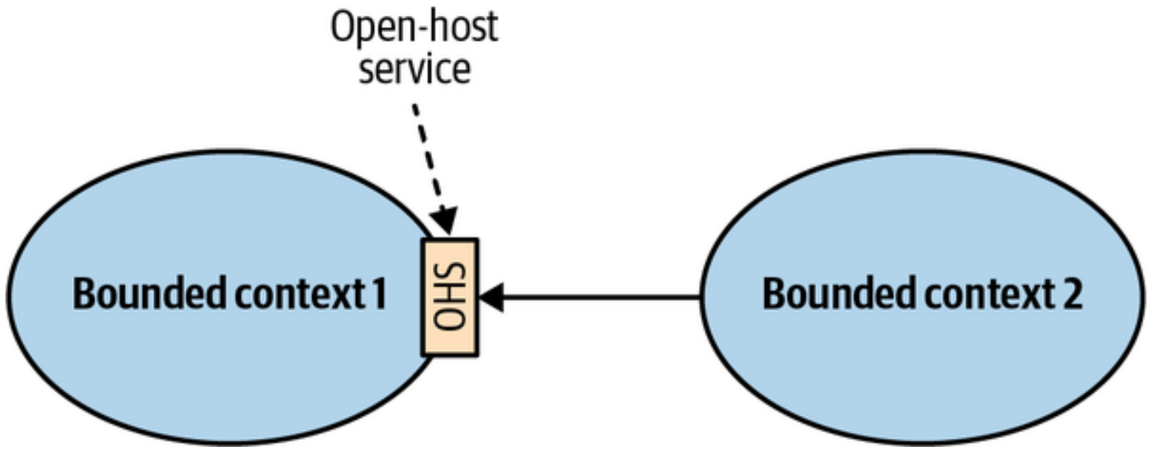
Reasons for Anti-Corruption Layer

- A core subdomain’s model requires extra attention, and adhering to the supplier’s model might impede the modeling of the problem domain.
- When the upstream model is inefficient or inconvenient for the consumer’s needs
- If a bounded context conforms to a mess, it risks becoming a mess itself (legacy systems)
- When the supplier’s contract changes often, the consumer wants to protect its model from frequent changes

Open Host Service

- Power is toward the consumers
- Supplier is interested in protecting its consumers and providing the best service possible.
- Upstream supplier decouples the implementation model from the public interface.
- Allows the supplier to evolve its implementation and public models at different rates
- The supplier exposes a protocol convenient for the consumers



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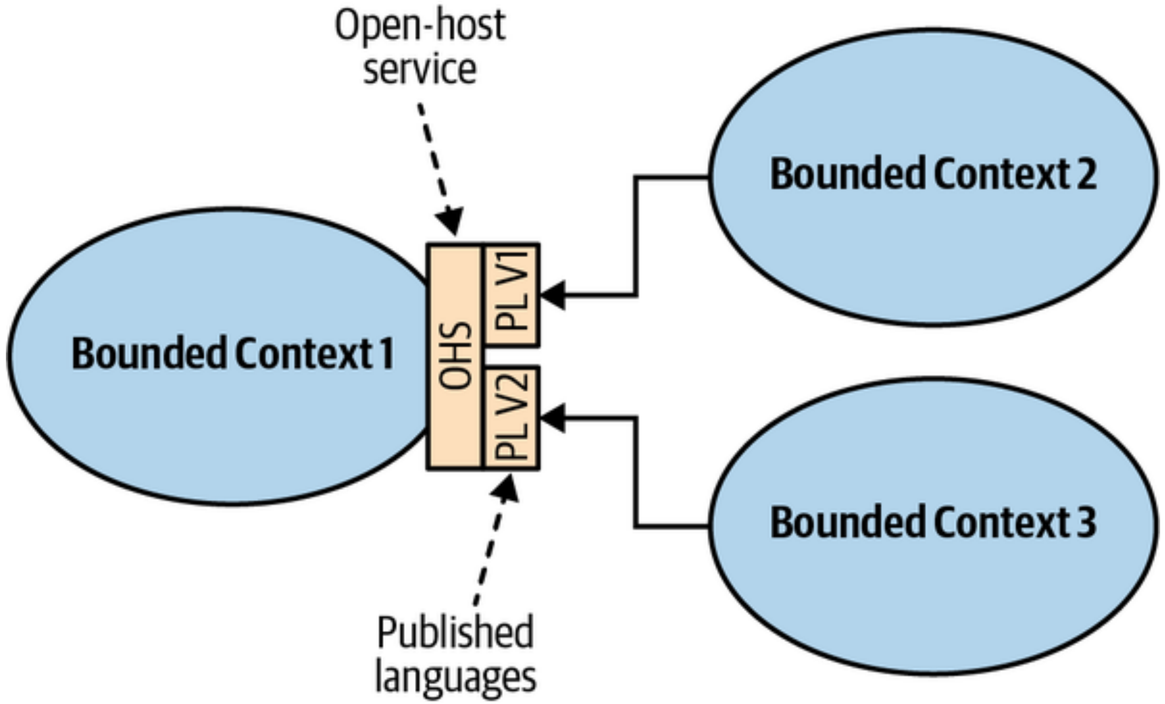
Published Language

- Publicly used to communicate and integrate between different Bounded Contexts.
- They also have an agreed-meaning across Bounded Contexts.
- Mainly used by engineers working in different Bounded Contexts to agree on integration approach (open-host, client-server, pub-sub, etc.).
- Mainly expressed via technical format (API, JSON, XML, Protocol Buffer, etc.)

Open Host Service Multiple Protocols

- Integration model's decoupling allows the upstream bounded context to simultaneously expose multiple versions of the published language
- Allowing the consumer to migrate to the new version gradually



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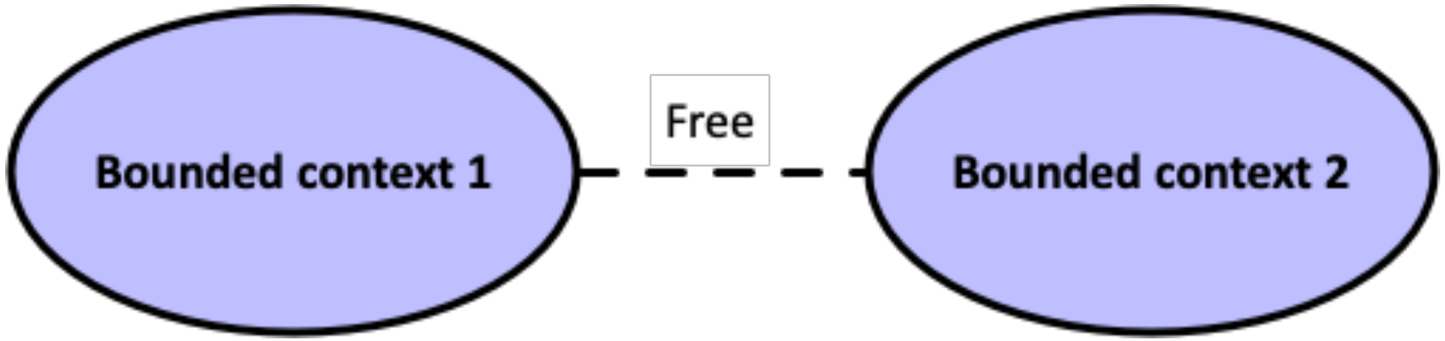
Separate Ways/Free

- Last option or pattern is not to collaborate at all for the following reasons:
  - **Communication Issues -** Organization Size and Politics hinders collaboration
  - **Generic Subdomains -** If the generic solution is easy to integrate, it may be more cost-effective to integrate it locally in each bounded context.
  - **Model Differences -** The models may be so different that a conformist relationship is impossible. Implementing an anticorruption layer would be more expensive than duplicating the functionality



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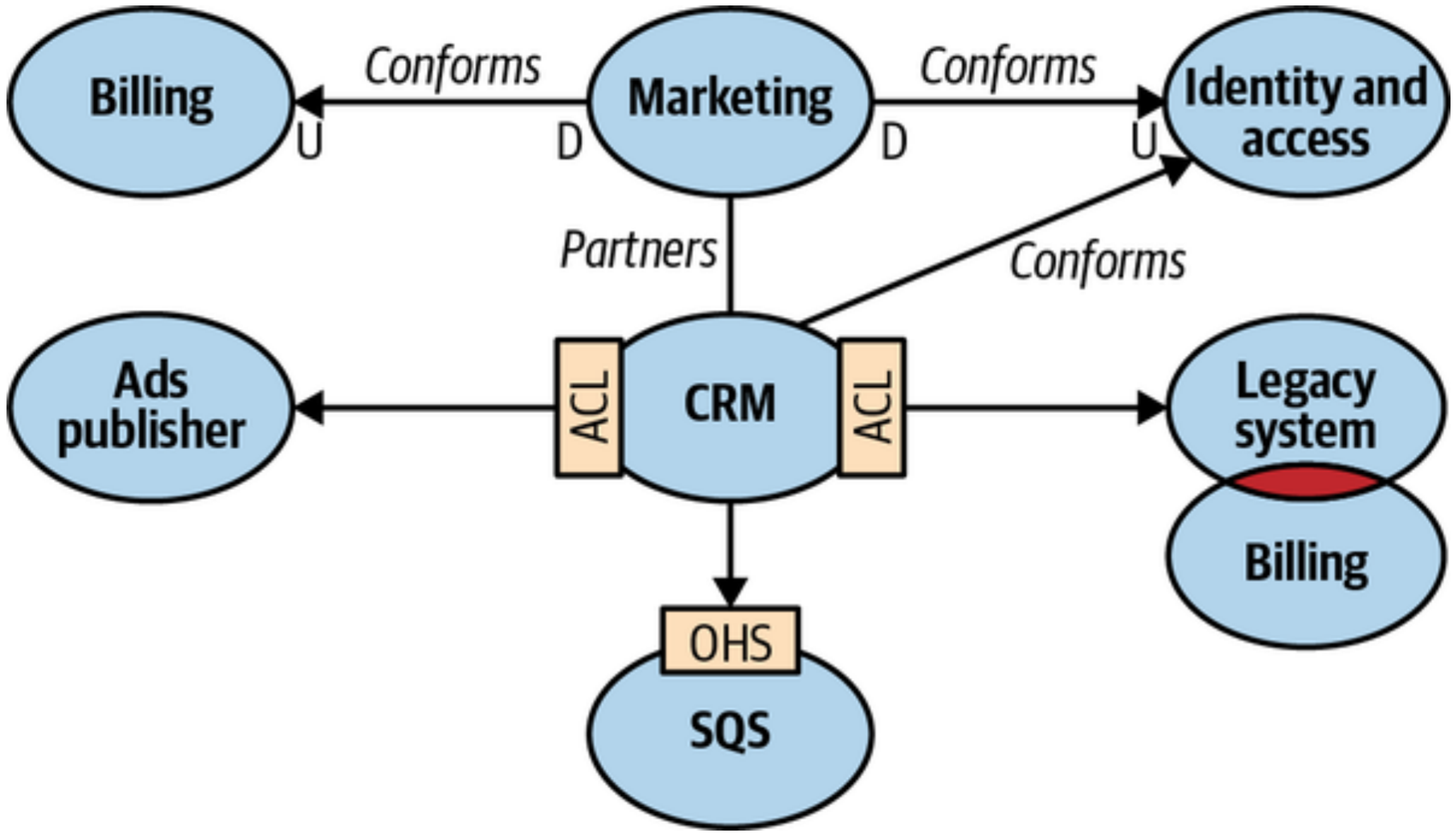
Creating a Context Map

Context map is a visual representation of the system's bounded contexts and the integrations between them



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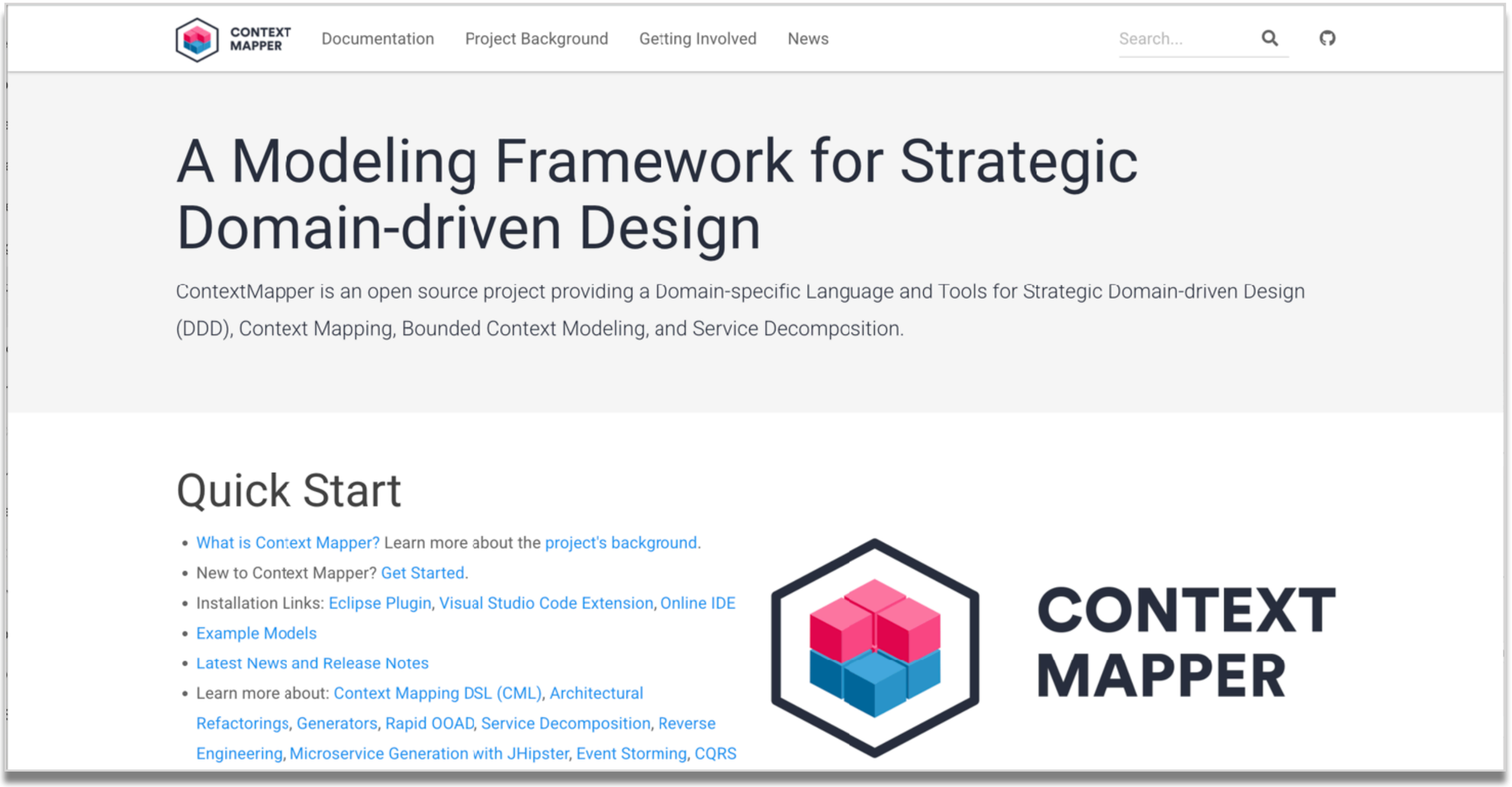


https://contextmapper.org/

Demo: Context Mapper

- Let’s see briefly what a context mapper looks like.

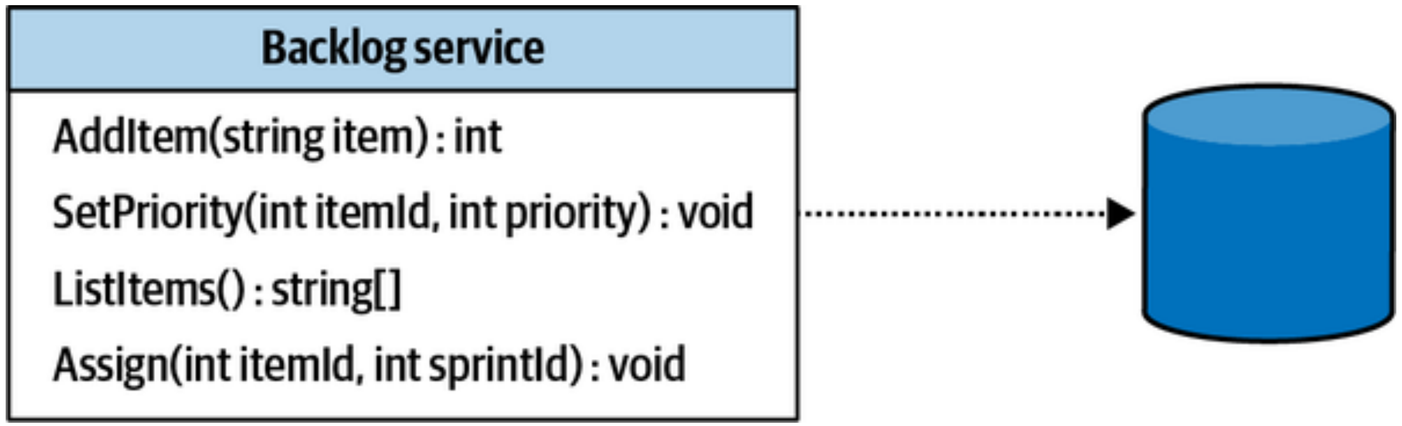
Simple Applications [Tactical]

Simple Business Logic

- For supporting subdomains we can use either one of these software architectures:
  - Transaction Script
  - Active Record

Transaction Script

- Organizes business logic by procedures where each procedure handles a single request from the presentation
- A system’s public interface can be seen as a collection of business transactions that consumers can execute
- Transactions can retrieve information managed by the system, modify it, or both
- Pattern organizes the system’s business logic based on procedures
- Each procedure implements an operation that is executed by the system’s consumer via its public interface
- Public operations are used as encapsulation boundaries



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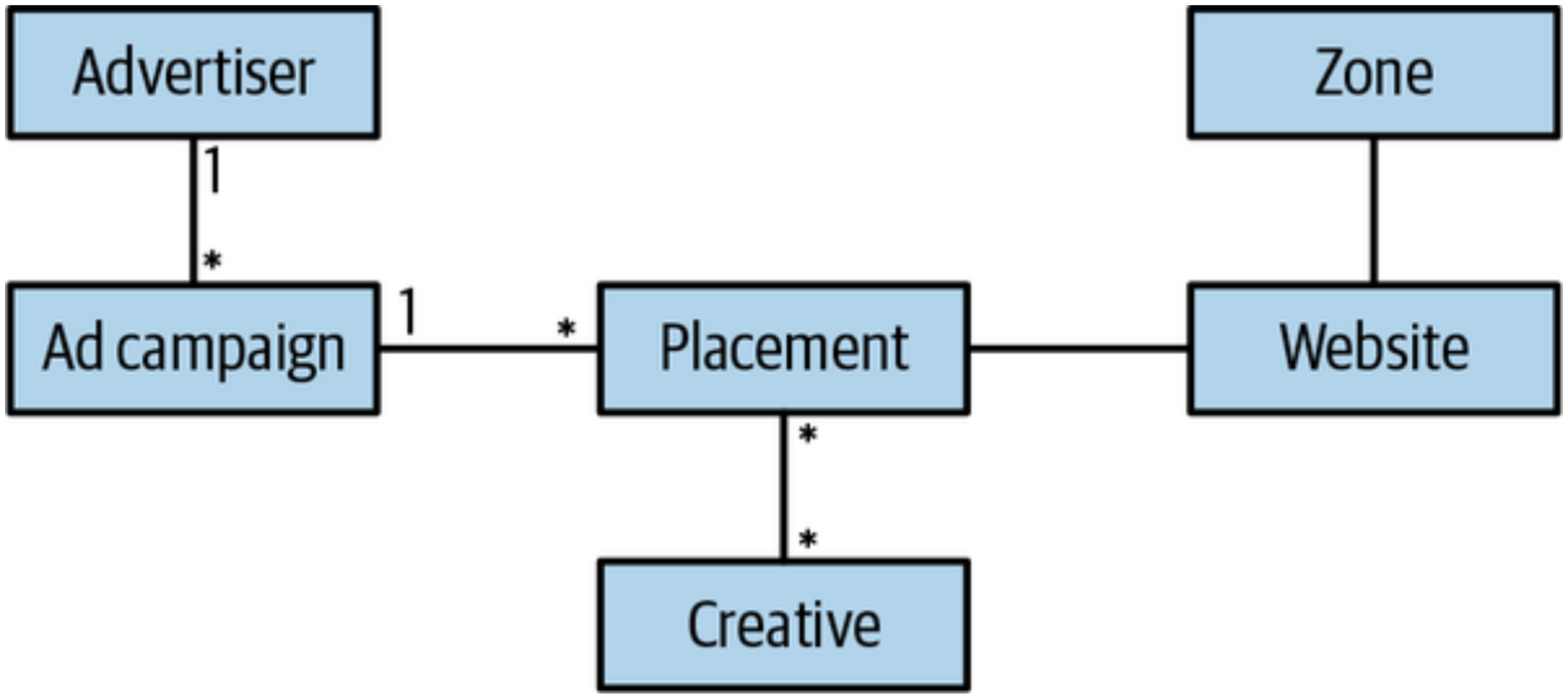
Demo: Transaction Scripts

- Let’s see an example of a transaction script

Active Record

- An object that wraps a row in a database table or view, encapsulates the database access, and adds domain logic on that data
- Active record supports cases where the business logic is simple
- Business logic may operate on more complex data structures which is different than transaction script
- Active record also supports complicated trees and hierarchies
- Doing something like the following diagram would make it so complicated for something like a transaction script which leads to repetitive code

Example of a Complex Active Record Structure



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Implementation of an Active Record

- Active Record uses dedicated objects, known as active records, to represent complicated data structures
- Active Record objects also implement data access methods for creating, reading, updating, and deleting records—the so-called CRUD operations
- Active record objects are coupled to an object-relational mapping (ORM) or some other data access framework

Advantages and Disadvantages to an Active Record

- **Advantage**
  - Active record is essentially a transaction script that optimizes access to databases
  - Can only support relatively simple business logic, such as CRUD operations, which, at most, validate the user's input
- **Disadvantage**
  - It can potentially introduce more harm than good when applied in the wrong context
  - It can be considered an anti-pattern, since it mixes two concerns, domain and repository

Demo: Active Records

- Let’s see an example of an active record

Complex Applications [Tactical]

Domain Model Pattern

- The domain model pattern is intended to cope with cases of complex business logic.
- Instead of CRUD, we deal with complex state transitions, business rules, and invariants

Implementation of the Domain Model Pattern

- A domain model is an object model of the domain that incorporates both behavior and data
- DDD's tactical patterns — aggregates, value objects, domain events, and domain services— are the building blocks of such an object model.
- All of these patterns share a common theme: they put the business logic first
- They will all be implemented in plain objects
  - No Infrastructure and no technology concerns like frameworks
- Adhere to all the correct terms: **Ubiquitous Language**

What goes in the Domain Model Pattern?

- Developers will develop the following software artifacts:
  - Value Objects
  - Entities
  - Aggregates
  - Domain Events
  - Domain Services
  - Application Services

Value Objects

- Object that can be identified by the composition of its values
- No explicit identification is required
- Changing the attributes of any of the fields yields a different object
- Value Objects can be used to counter the “Primitive Obsession” code smell
- Typically immutable

```
class Color {
    int red;
    int green;
    int blue;
}
```

Entities

- Opposite of a value object and requires explicit identification
- Explicit identification is required
- For example, an `Employee`, just identified by an employee's first name and last name
- Entities are subject to change

```
class Employee {
   private Name name;
   //Constructors,
   // equals, hashCode, etc.
}
```

```
class Employee {
   private EmployeeId employeeId;
   private Name name;
   //Constructors,
   // equals, hashCode, etc.
}
```

Aggregates

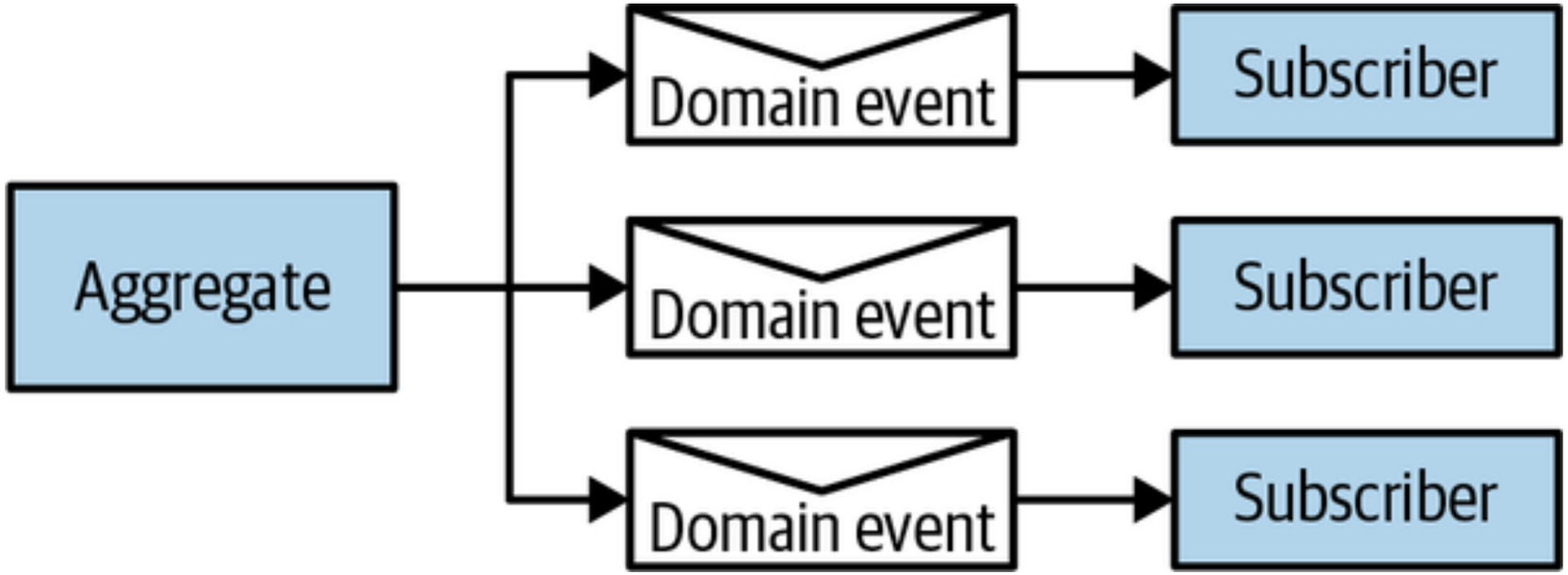
- An entity that manages a cluster of domain objects as a single unit
- Consider an `Order` to `OrderLineItem` relationship
- The root entity ensures the integrity of its parts
- Transactions should not cross aggregate boundaries
- They are domain objects(order, playlist), they are not collections, like `List`, `Set`, `Map`

```
class Album {
   private Name name;
   private List<Track> tracks;

   public void addTrack(Track track) {
      this.tracks.add(track);
   }

   public List<Track> getTracks() {
      return Collections.copy(tracks)
   }
}
```

Domain Events

- The identified domain events directly become domain events in the implementation.
- These are immutable objects that capture significant occurrences in the business domain, reflecting changes in state or triggering further actions within the system.
- The events can then emitted from the aggregates and perform other functions

```
public class Ticket {
    private List<DomainEvent> domainEvents;
    public void execute(RequestEscalation cmd) {
        if (!this.isEscalated &&
            this.remainingTimePercentage <= 0) {
               this.isEscalated = true;
               var escalatedEvent =
                   new TicketEscalated(id, cmd.Reason);
            domainEvents.append(escalatedEvent);
        }
    }
}
```



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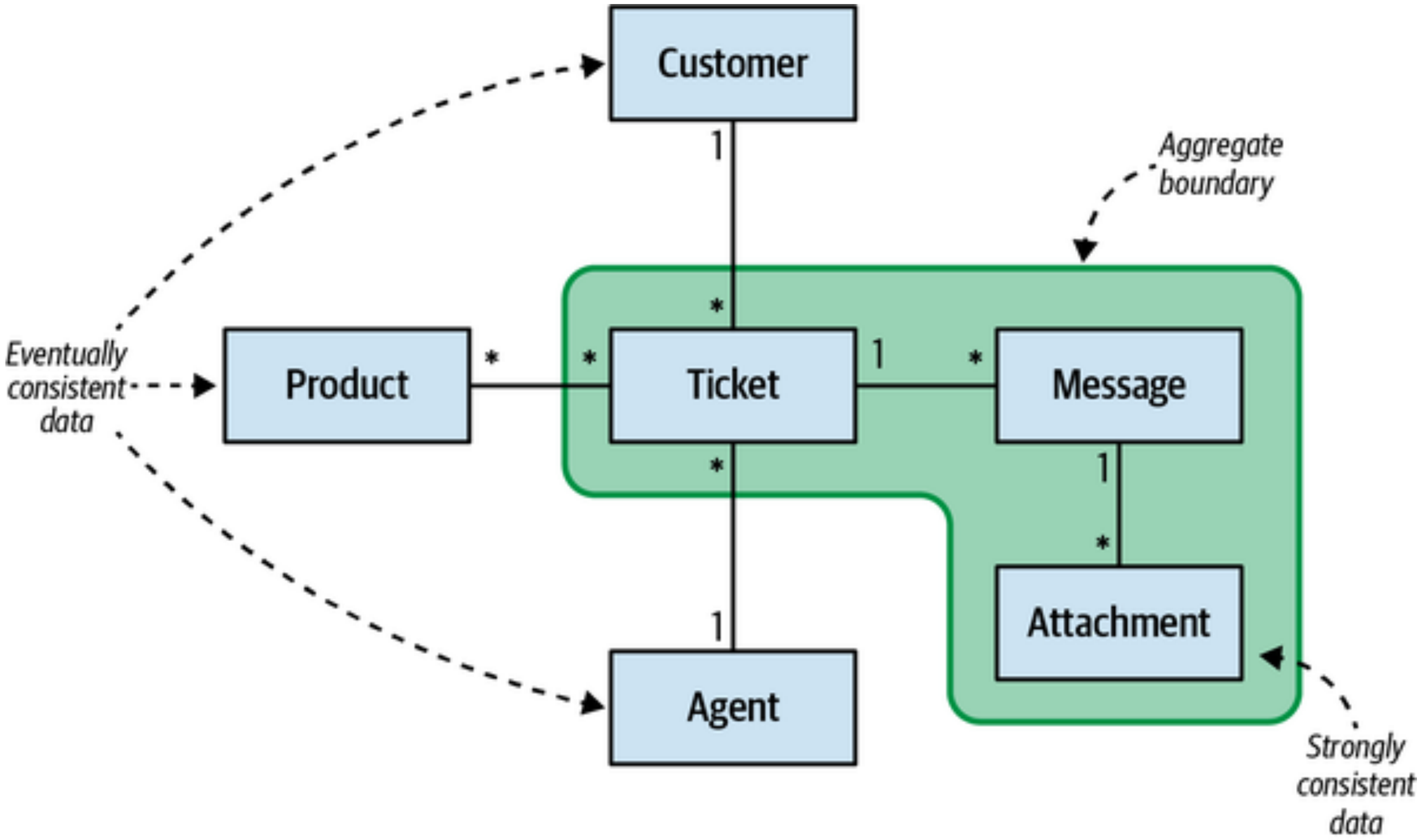
Aggregate as a Consistency Boundary



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Keep Aggregates Small

- Keep the aggregates as small as possible and include only objects that are required to be in a strongly consistent state by the aggregate's business logic
- In the following code example, notice that we are not interested in the entire `Product` nor the entire `User`, just their identifiers (entities)

```
public class Ticket {
    private UserId          customer;
    private List<ProductId> products;
    private UserId          assignedAgent;
    private List<Message>   messages;
}
```

- Reasoning behind referencing external aggregates by ID is to reify that these objects do not belong to the aggregate's boundary, and to ensure that each aggregate has its own transactional boundary.

Domain Services

- Stateless object that implements the business logic
- It naturally doesn’t belong to any of the domain model’s aggregates or value objects

```
class OrderTax {
   //no state
   private void calculateTaxWithRate(Order
         order, TaxRate taxRate) {
       //...
   }
}
```

Application Services

- Makes use of Repositories (Storage Abstractions)
- Aggregate instances and then sent for transforming to a transformed object
- The transformed object will typically be routed to the UI

```
class OrderService {
    private OrderRepository orderRepository;
    private void persistOrder(Order) {
        //...
    }
}
```

Demo: Domain Model

- Let’s view a Domain Model with Entities, Value Objects, Application Services, etc.

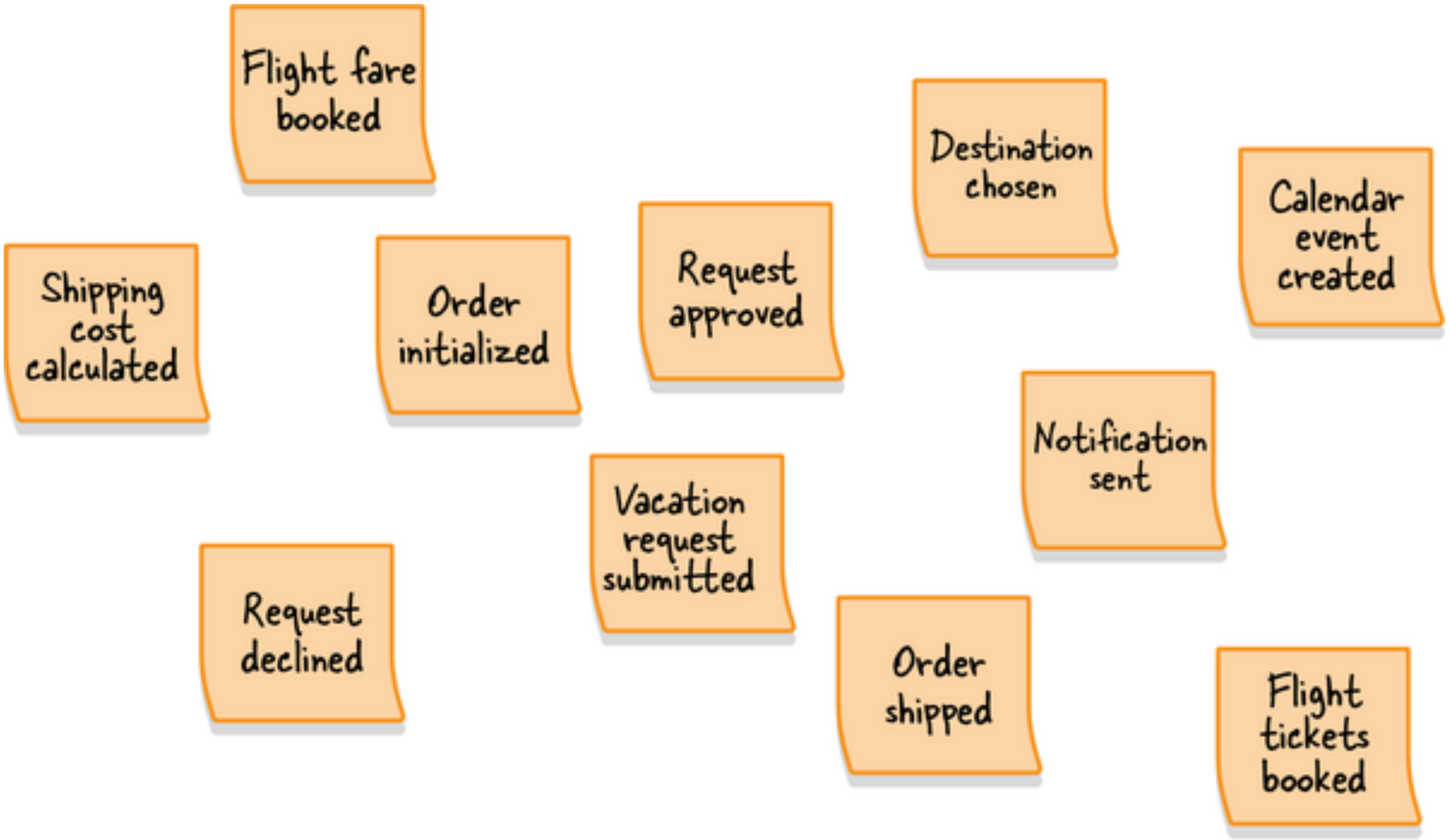
Event Storming [Tactical]

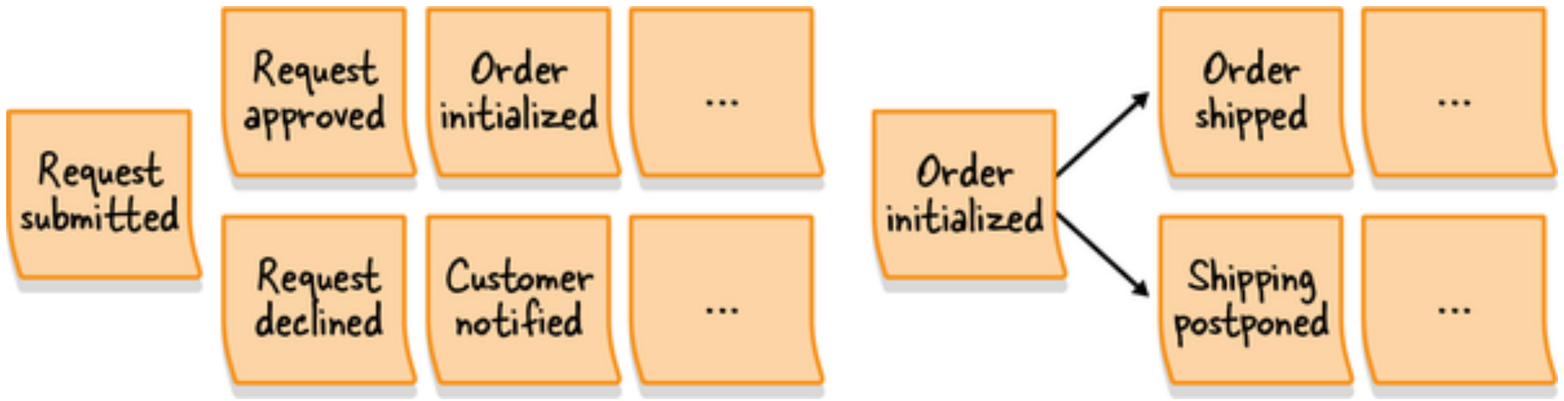
Event Storming

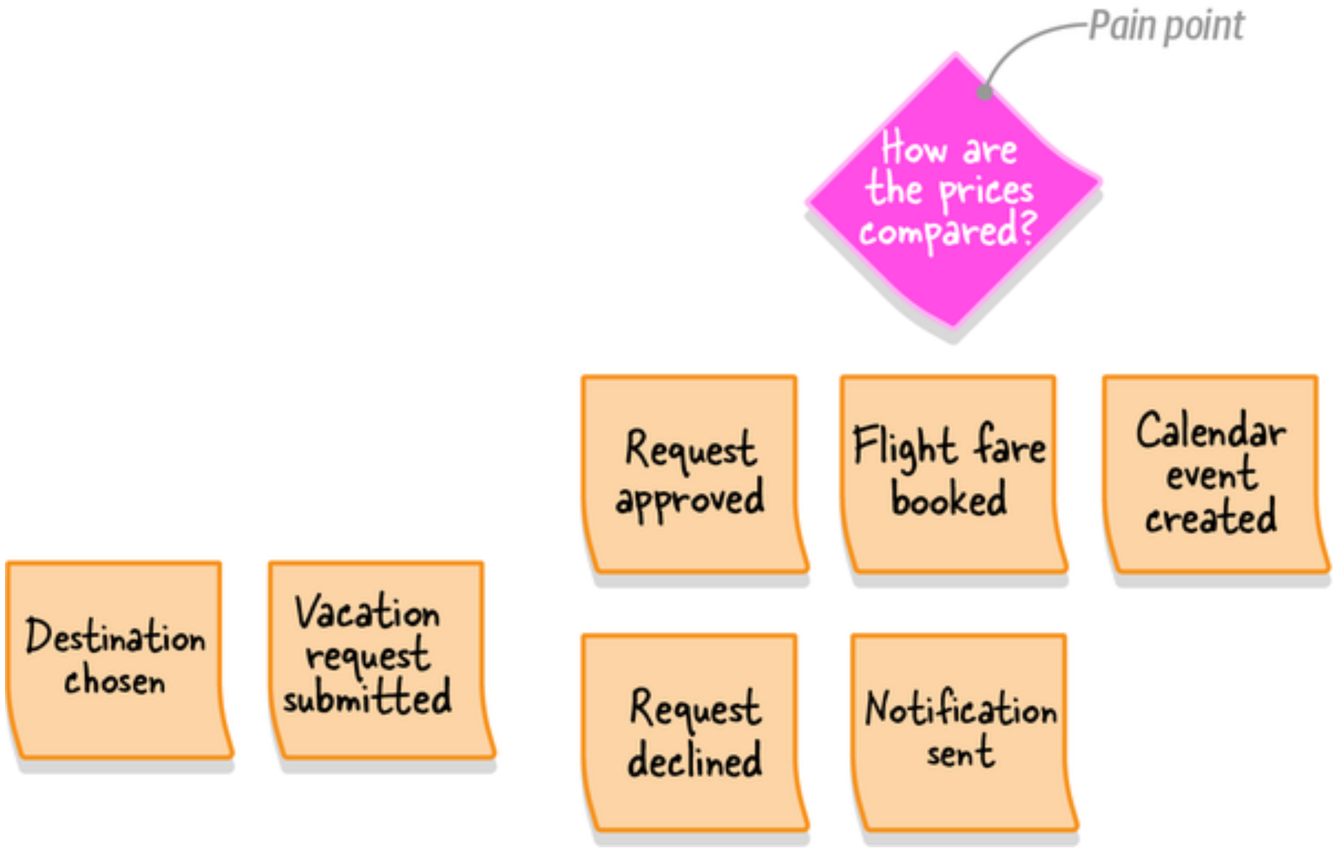
- Low-tech activity for a group of people to brainstorm and rapidly model a business process.
- In a sense, EventStorming is a tactical tool for sharing business domain knowledge.
- An EventStorming session has a scope: the business process that the group is interested in exploring.
- The participants are exploring the process as a series of domain events, represented by sticky notes, over a timeline. Step by step, the model is enhanced with additional concepts—actors, commands, external systems, and others—until all of its elements tell the story of how the business process works.

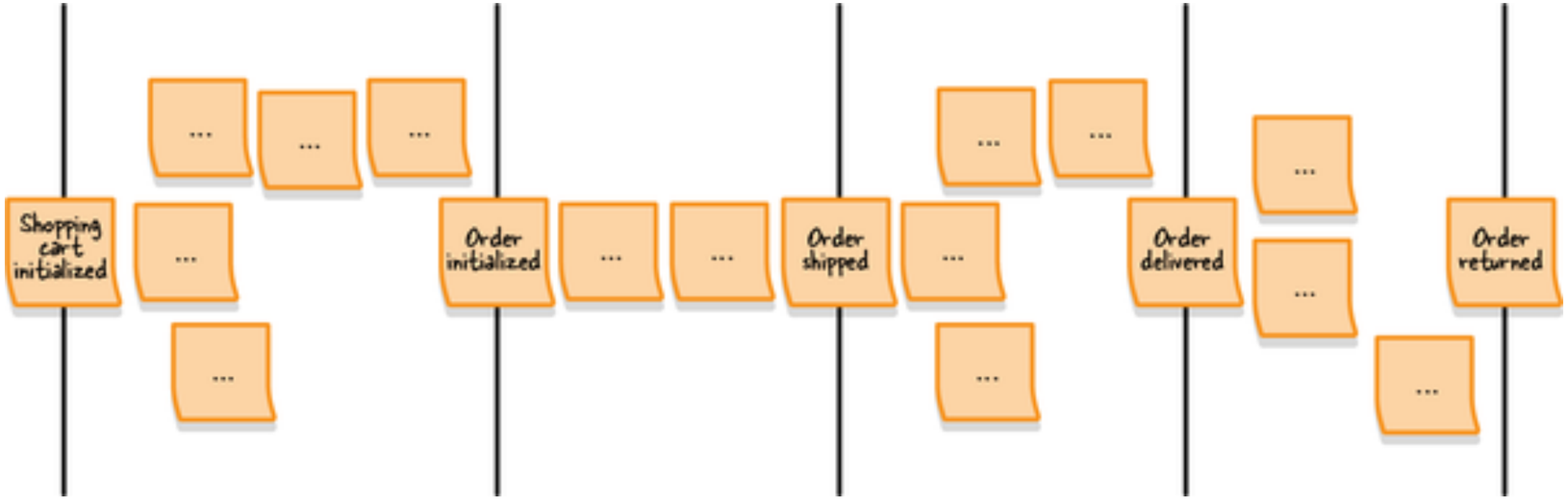
“Just keep in mind that the goal of the workshop is to learn as much as possible in the shortest time possible. We invite key people to the workshop, and we don’t want to waste their valuable time”

— Alberto Brandolini: Creator of the EventStorming workshop


Flight fare booked
Destination chosen
Calendar event created
Shipping cost calculated
Order initialized
Request approved
Notification sent
Vacation request submitted
Request declined
Order shipped
Flight tickets booked


Request submitted
Request approved
Order initialized
...
Request declined
Customer notified
...
Order initialized
Order shipped
...
Shipping postponed
...


Pain point
How are the prices compared?
Request approved
Flight fare booked
Calendar event created
Destination chosen
Vacation request submitted
Request declined
Notification sent



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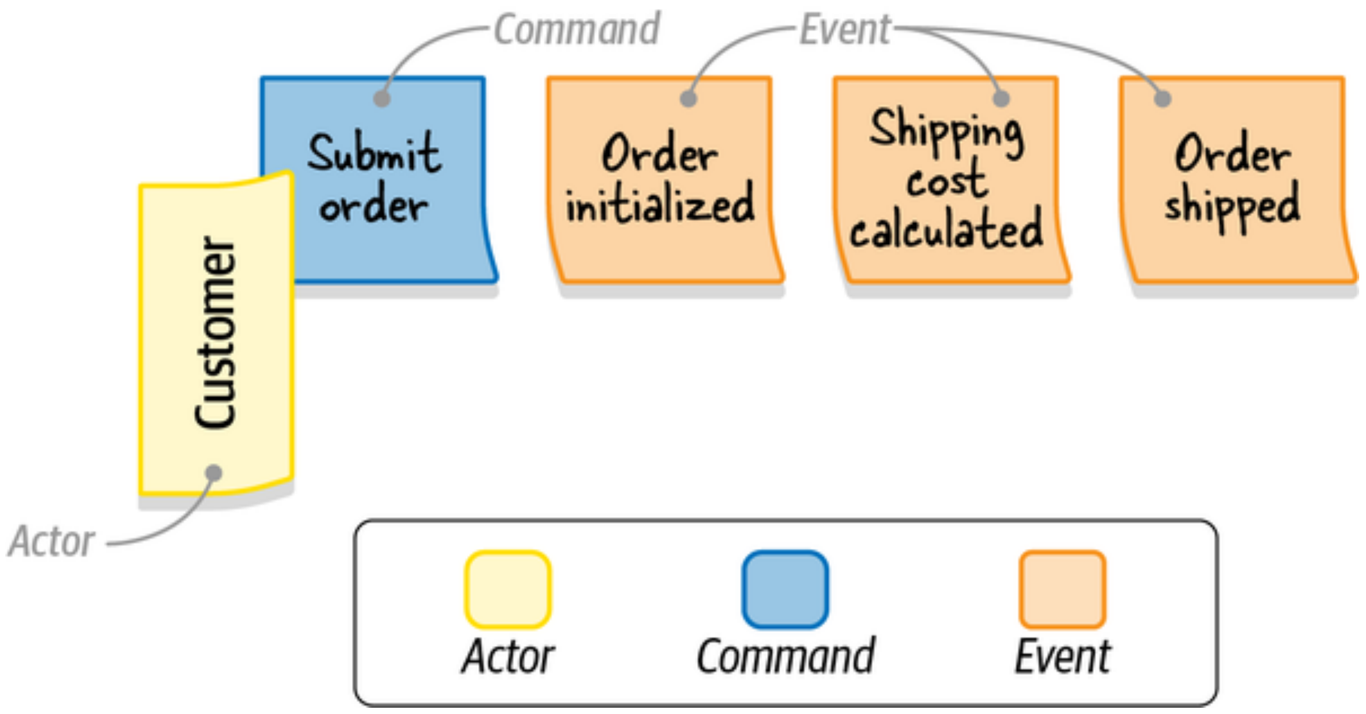
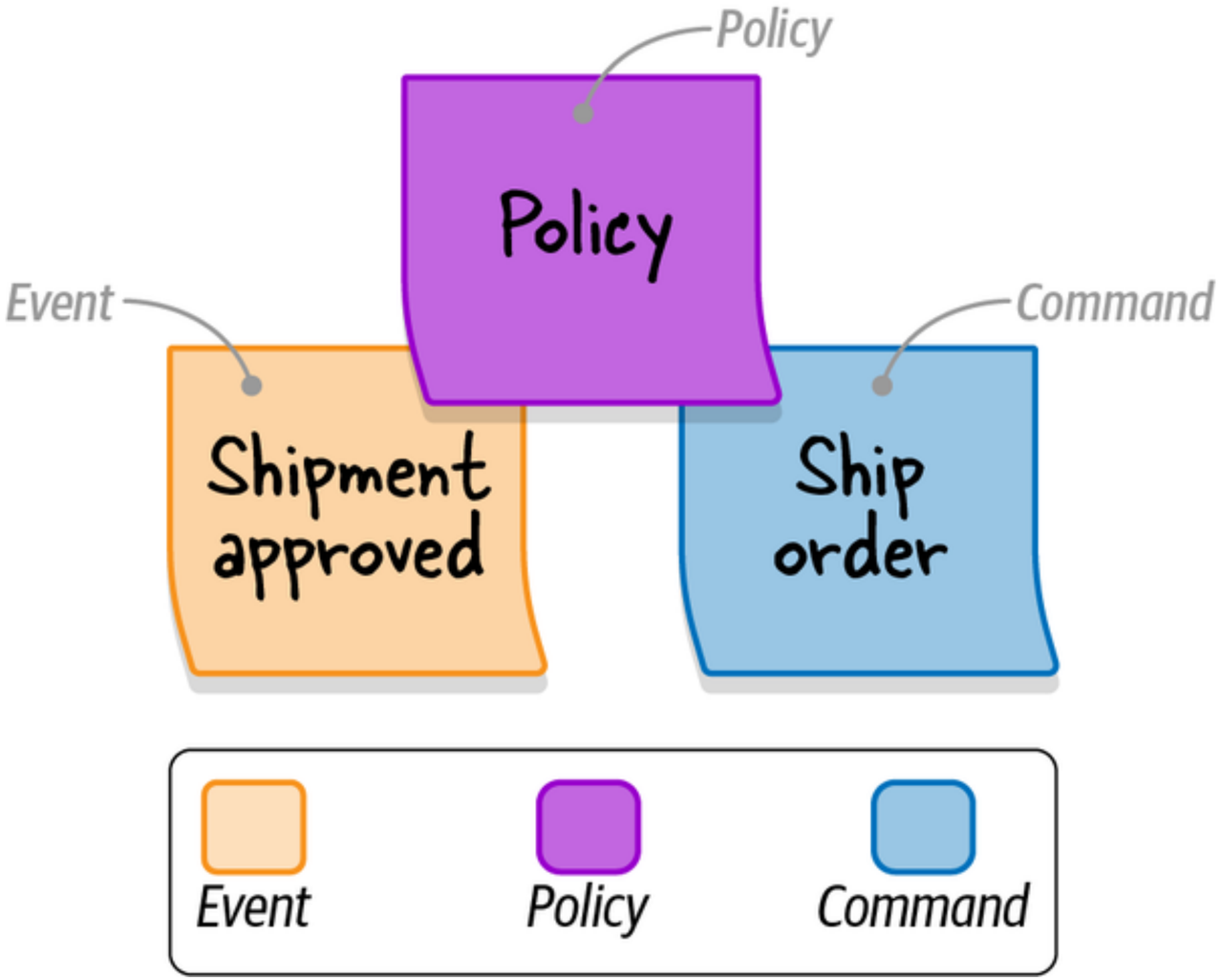
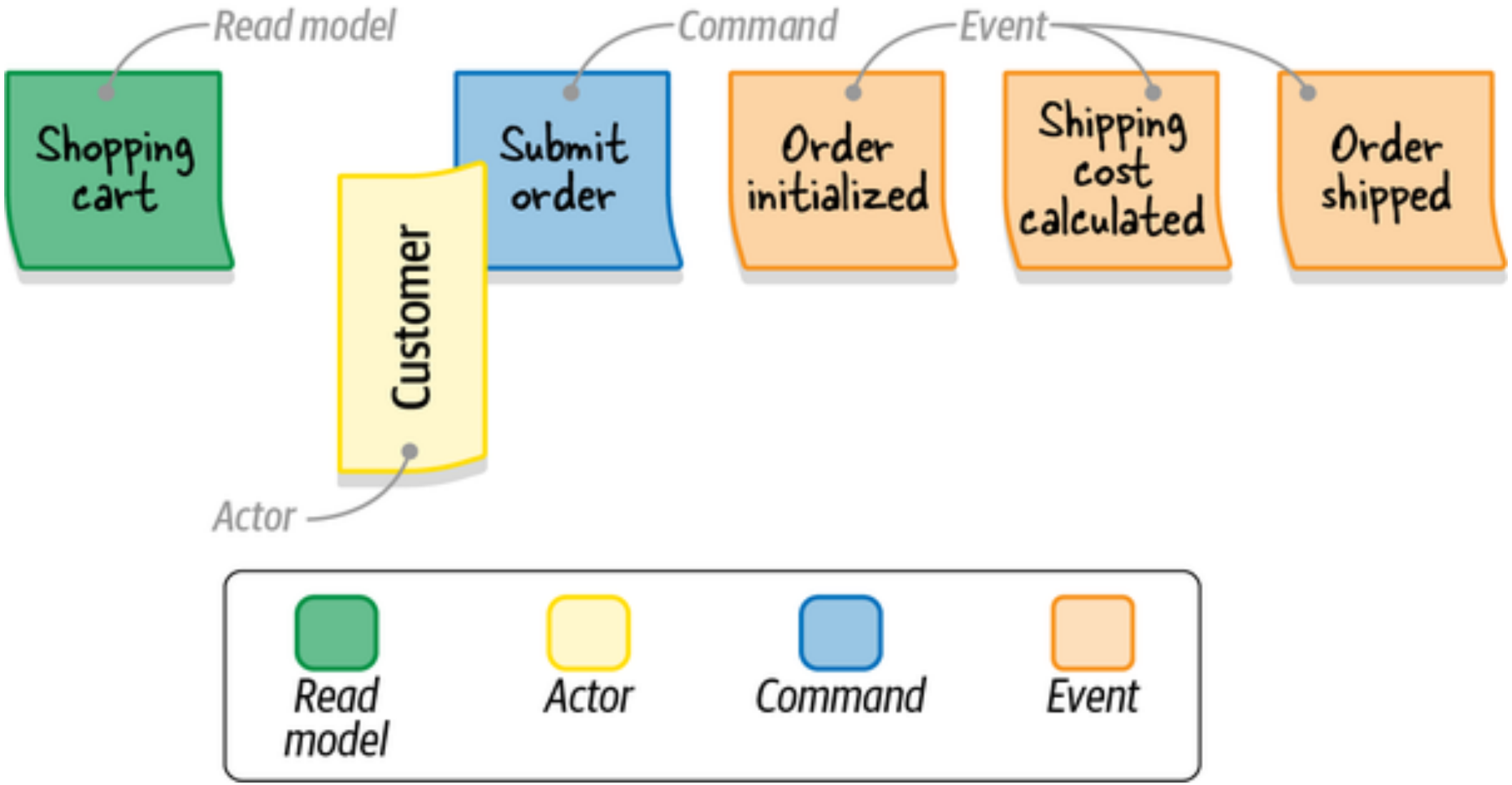
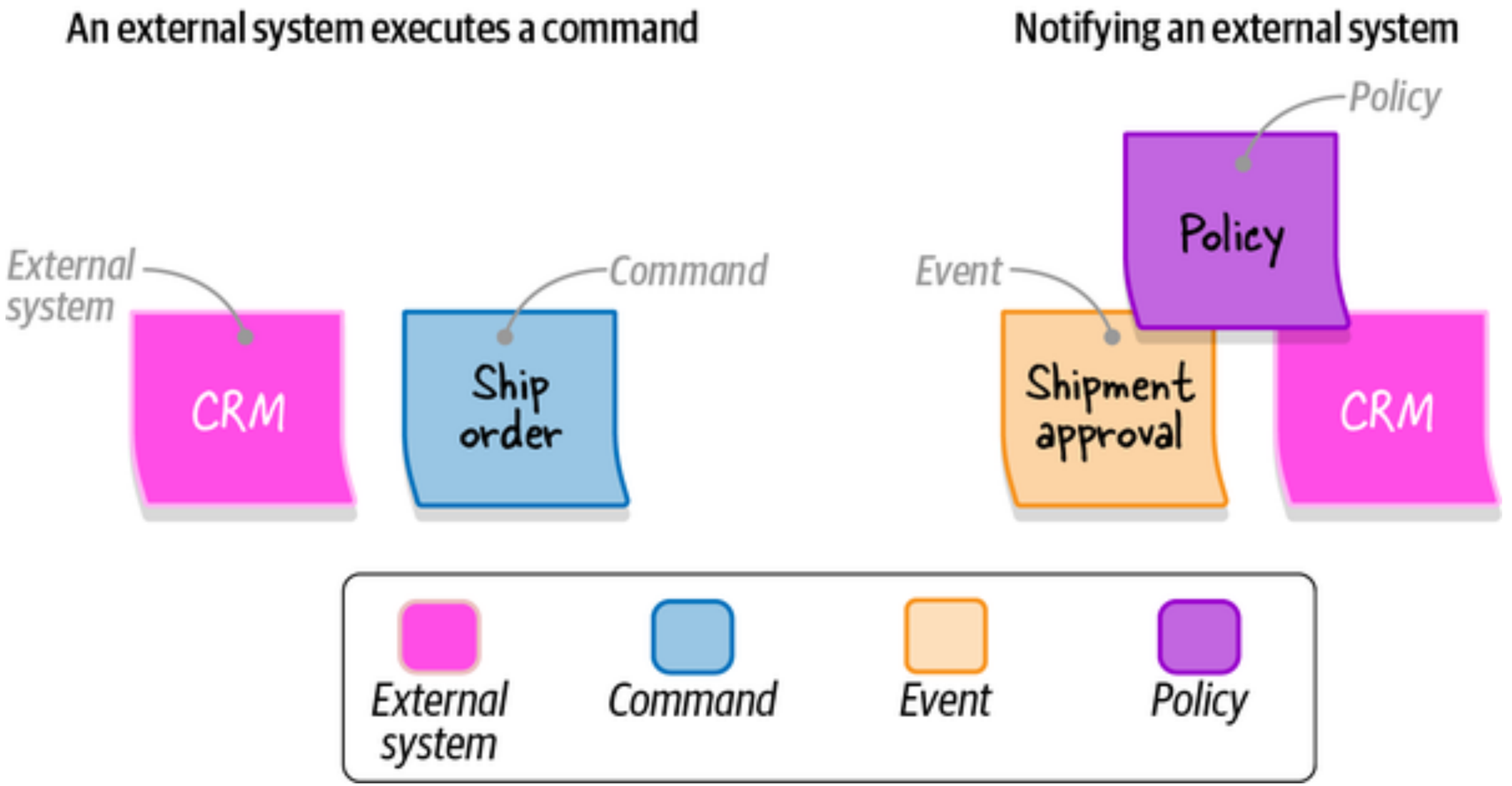
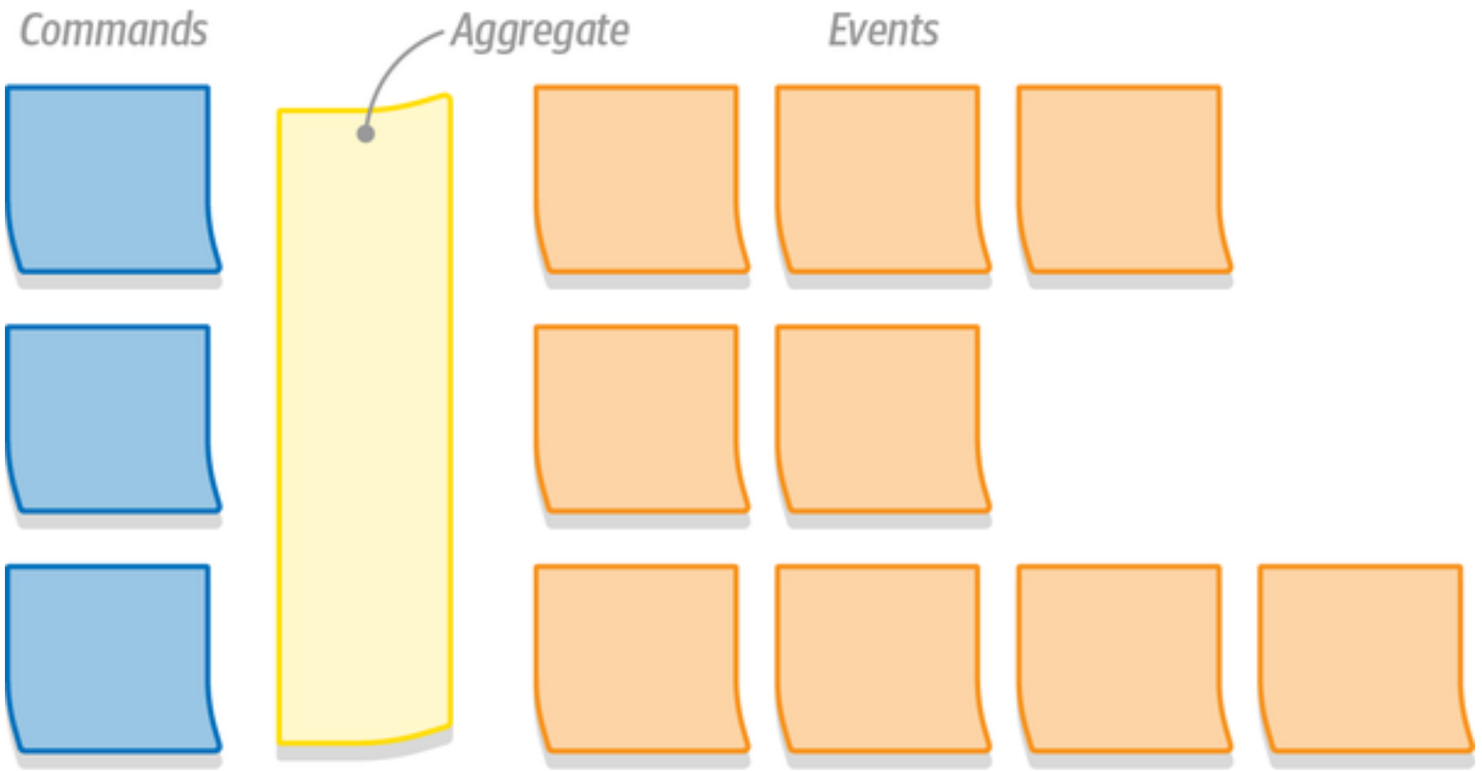

Command
Event
Submit order
Order initialized
Shipping cost calculated
Order shipped
Customer
Actor
Actor
Command
Event


Policy
Policy
Event
Shipment approved
Command
Ship order
Event
Policy
Command


Read model
Command
Event
Shopping cart
Submit order
Order initialized
Shipping cost calculated
Order shipped
Customer
Actor
Read model
Actor
Command
Event


An external system executes a command
External system
CRM
Command
Ship order
Notifying an external system
Policy
Policy
Event
Shipment approval
CRM
External system
Command
Event
Policy



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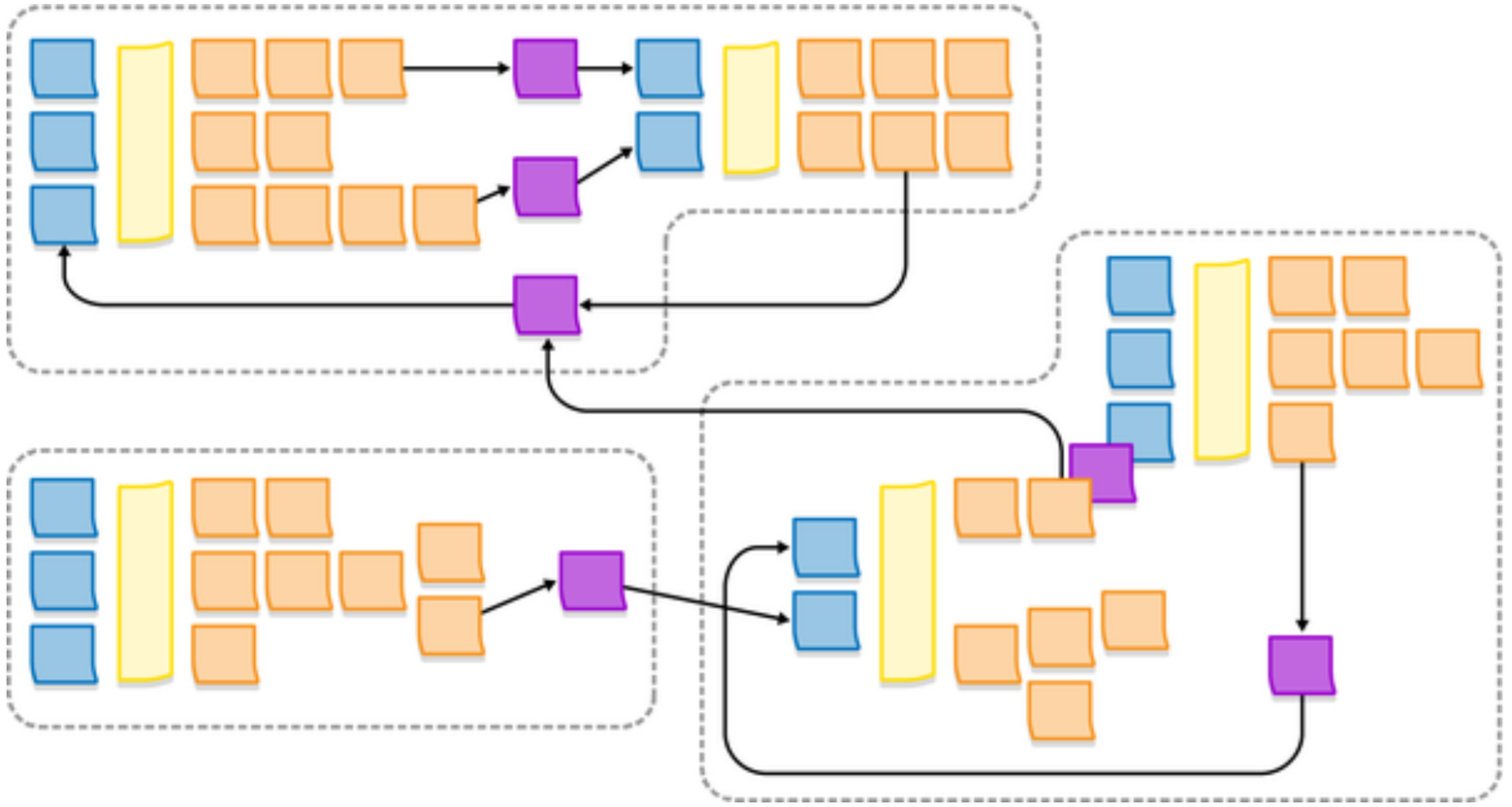

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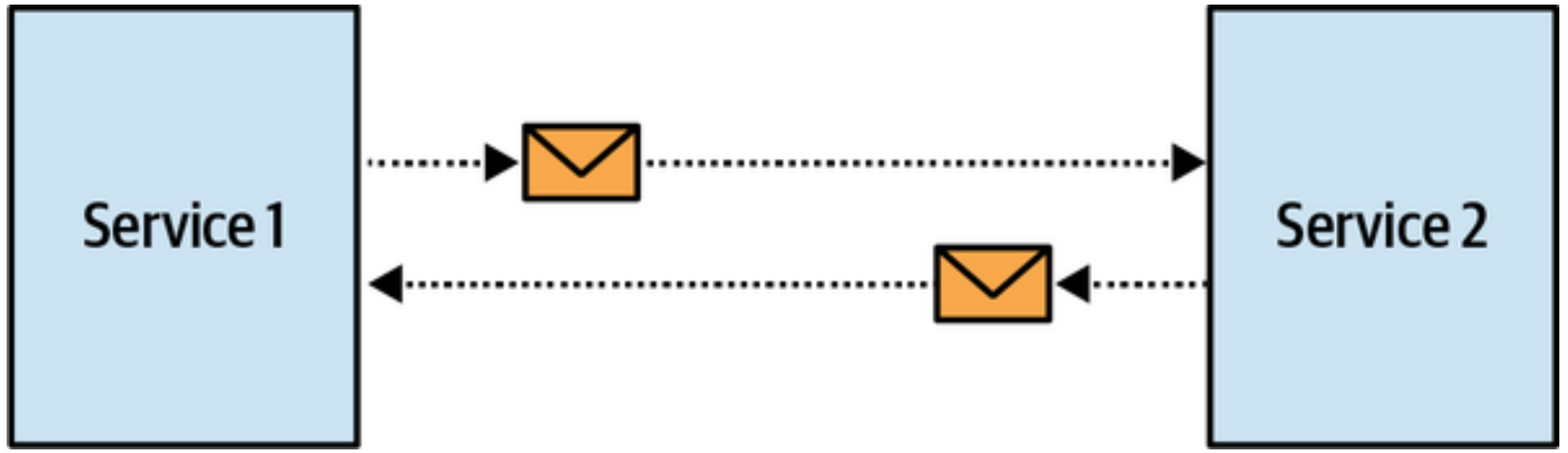
Why do you need to know DDD now?

Why is DDD a must know today?

- Basis for Event Driven Architecture
- Basis for Data Management and Data Mesh
- Basis for Team Organization

Event Driven Architecture

- Architectural style in which a system’s components communicate with one another asynchronously by exchanging event message
- Instead of calling the services’ endpoints synchronously, the components publish events to notify other system elements of changes in the system’s domain.
- The components can subscribe to events raised in the system and react accordingly


Service 1
Service 2

Two Types of Messages

- **Event**
  - A message describing a change that has already happened
- **Command**
  - A message describing an operation that has to be carried out

Event Sourcing

- Events are recorded in an append only store
- Events are described with discrete events like:
  - `AddedItemToCart`
  - `RemovedItemFromCart`
  - `ClearedCart`

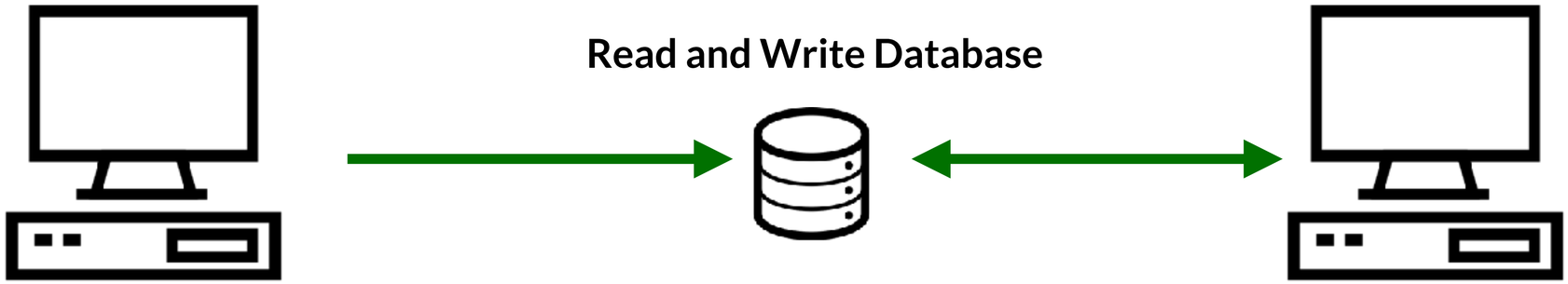
- Therefore it can be used to materialize view, prepare the data for the purposes of being efficiently read by a UI or business analytics for consumption
- Remember the orange sticky notes?

CQRS

- **Command and Query Responsibility Segregation**
- Separating reads, add-updates, for a databases
- Benefits include better performance, scalability, and security
- Better evolution over time

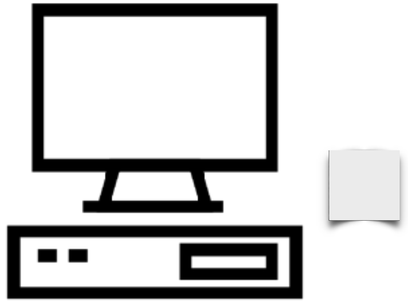
The Diagram

What if we need to query...
`SELECT state, count(*) from orders group by state`, over and over?



State	Amount	Customer
NY	4000	Carlos
AZ	300	Ann
CA	1000	Pritha
CA	340	Antoni
AZ	2133	Amani

The Diagram



Write Database

State	Amount	Customer
NY	4000	Carlos
AZ	300	Ann
CA	1000	Pritha
CA	340	Antoni
AZ	2133	Amani

Read Database

State	Total
NY	4000
AZ	2433
CA	1340

The Diagram

Write Database

State	Amount	Customer
NY	4000	Carlos
AZ	300	Ann
CA	1000	Pritha
CA	340	Antoni
AZ	2133	Amani
NY	900	Widelene

Read Database

State	Total
NY	4000
AZ	2433
CA	1340

The Diagram

Write Database

State	Amount	Customer
NY	4000	Carlos
AZ	300	Ann
CA	1000	Pritha
CA	340	Antoni
AZ	2133	Amani
NY	900	Widelene

Read Database

State	Total
NY	4900
AZ	2433
CA	1340

Data Mesh

- Data can be siloed Database per Service. To circumvent, we created a data lake or shared database
- Problem is that the data lake, ended up as a data monolith
- By using a shared storage, we lost governance, and ownership
- We wanted to apply bounded context patterns, and did so with services, but lost the point with data.

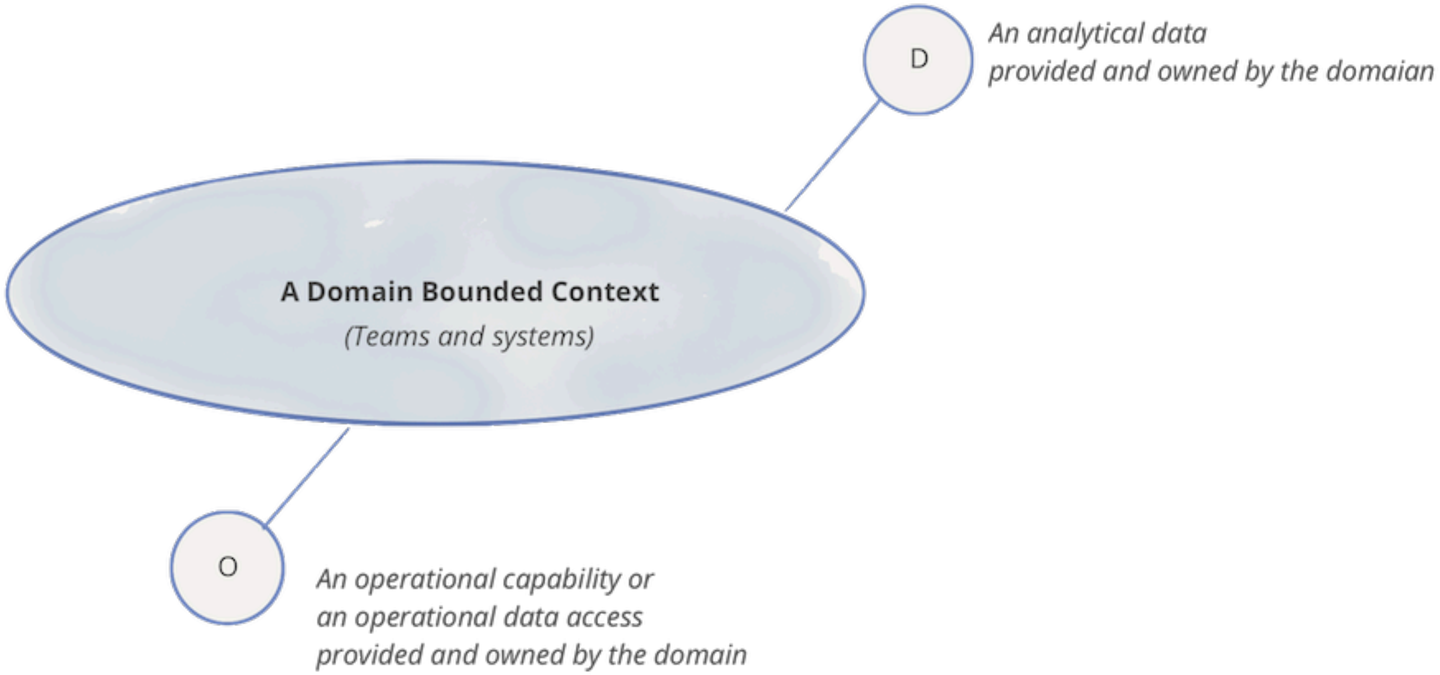
Data Mesh

- There are two patterns: Database per Service, and Shared Database
- Data Mesh is an attempt at bringing not only the database but owning all data
- Data Mesh is about providing data ownership per context, and follows these principles:
  - Domain-oriented decentralized data ownership and architecture
  - Data as a product
  - Self-serve data infrastructure as a platform
  - Federated computational governance
  - The accountability of data quality shifts upstream as close to the source of the data as possible.

The corps was composed of all arms of the service, was **self-sustaining**, and could fight on its own until other corps could join in the battle. The corps itself was a headquarters to which units could be attached. **It might have attached two to four divisions of infantry with their organic artillery, it had its own cavalry division and corps artillery, plus support units**. With this organization a corps was expected to be able to hold its ground against, or fight off an enemy army for a least a day, when neighboring corps could come to its aid. "Well handled, it can fight or alternatively avoid action, and maneuver according to circumstances without any harm coming to it, because an opponent cannot force it to accept an engagement but if it chooses to do so it can fight alone for a long time."

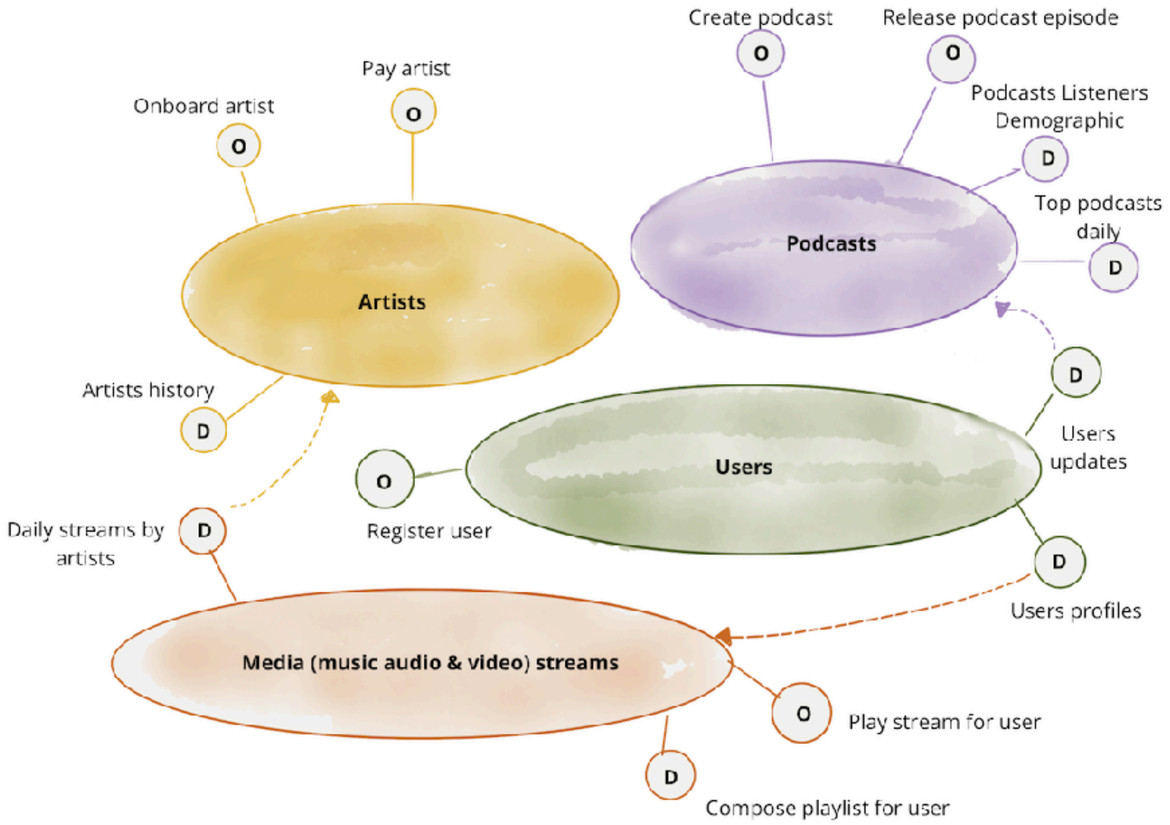
https://www.napoleon-series.org/military-info/organization/c_armycorps.html

The Diagram



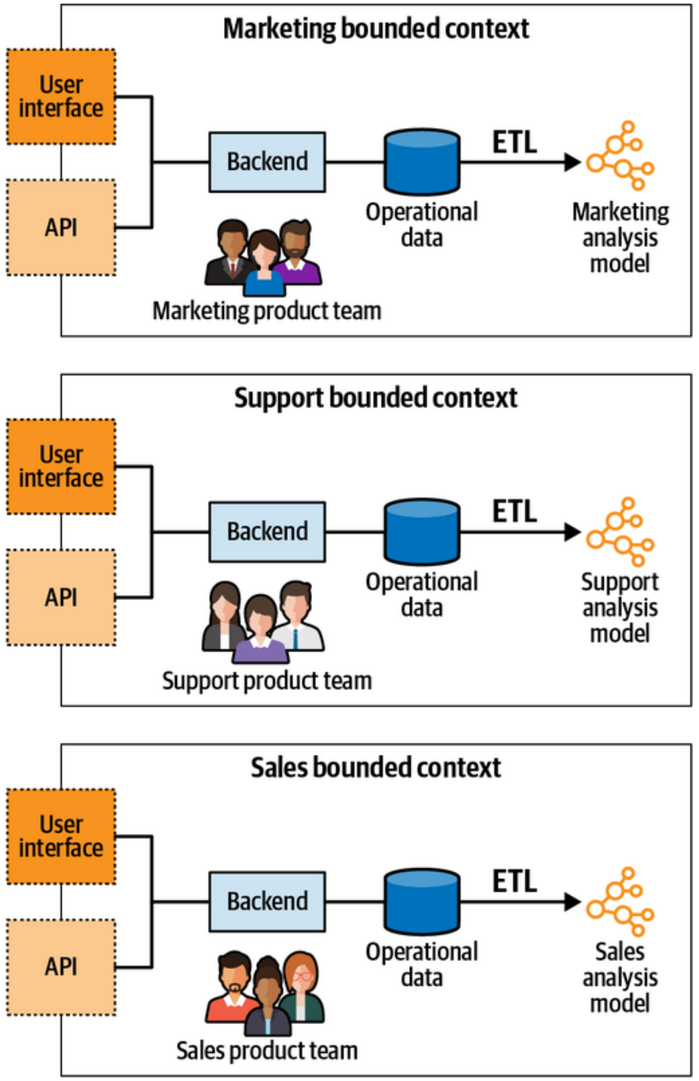
https://martinfowler.com/articles/data-mesh-principles.html

The Diagram

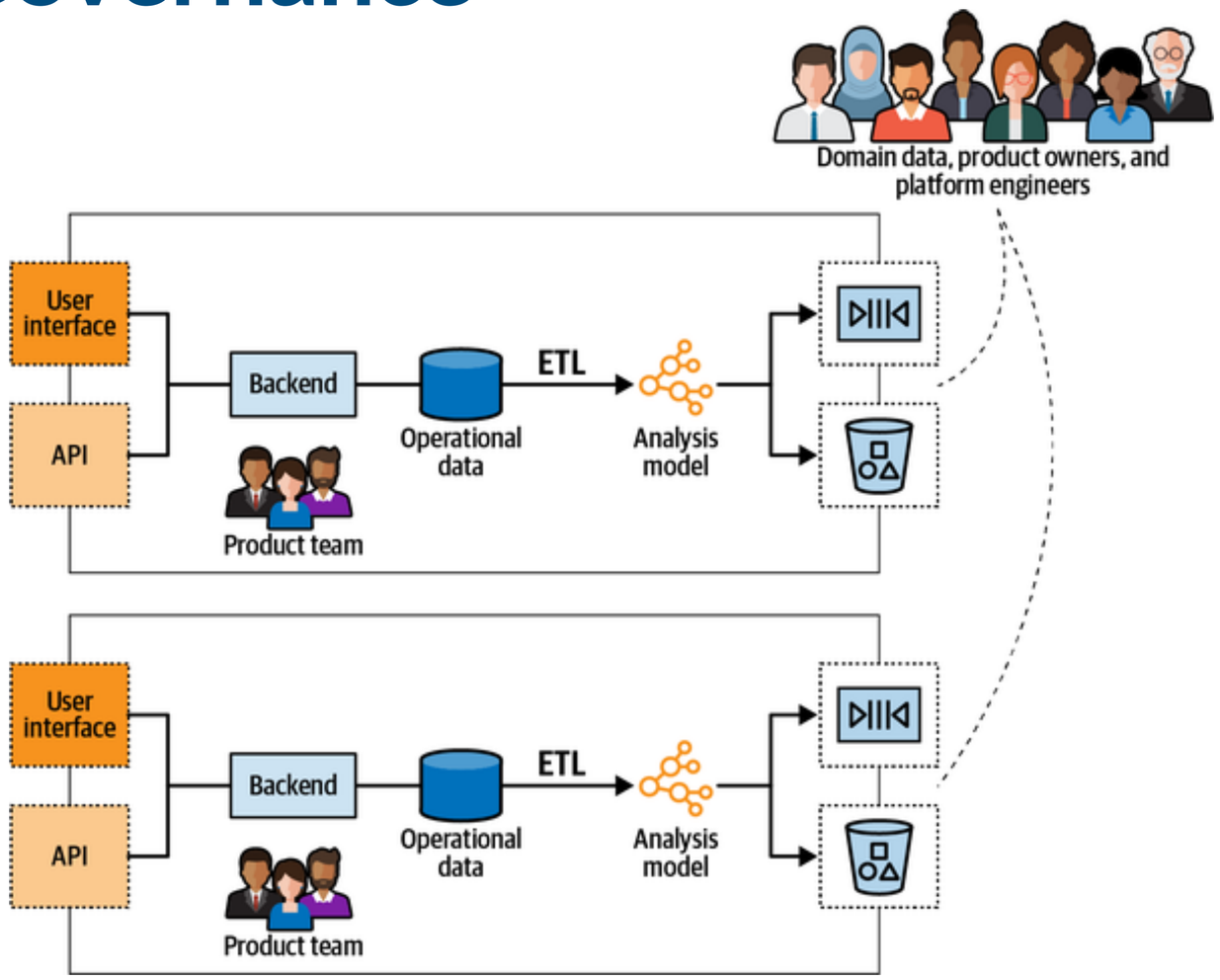


https://martinfowler.com/articles/data-mesh-principles.html

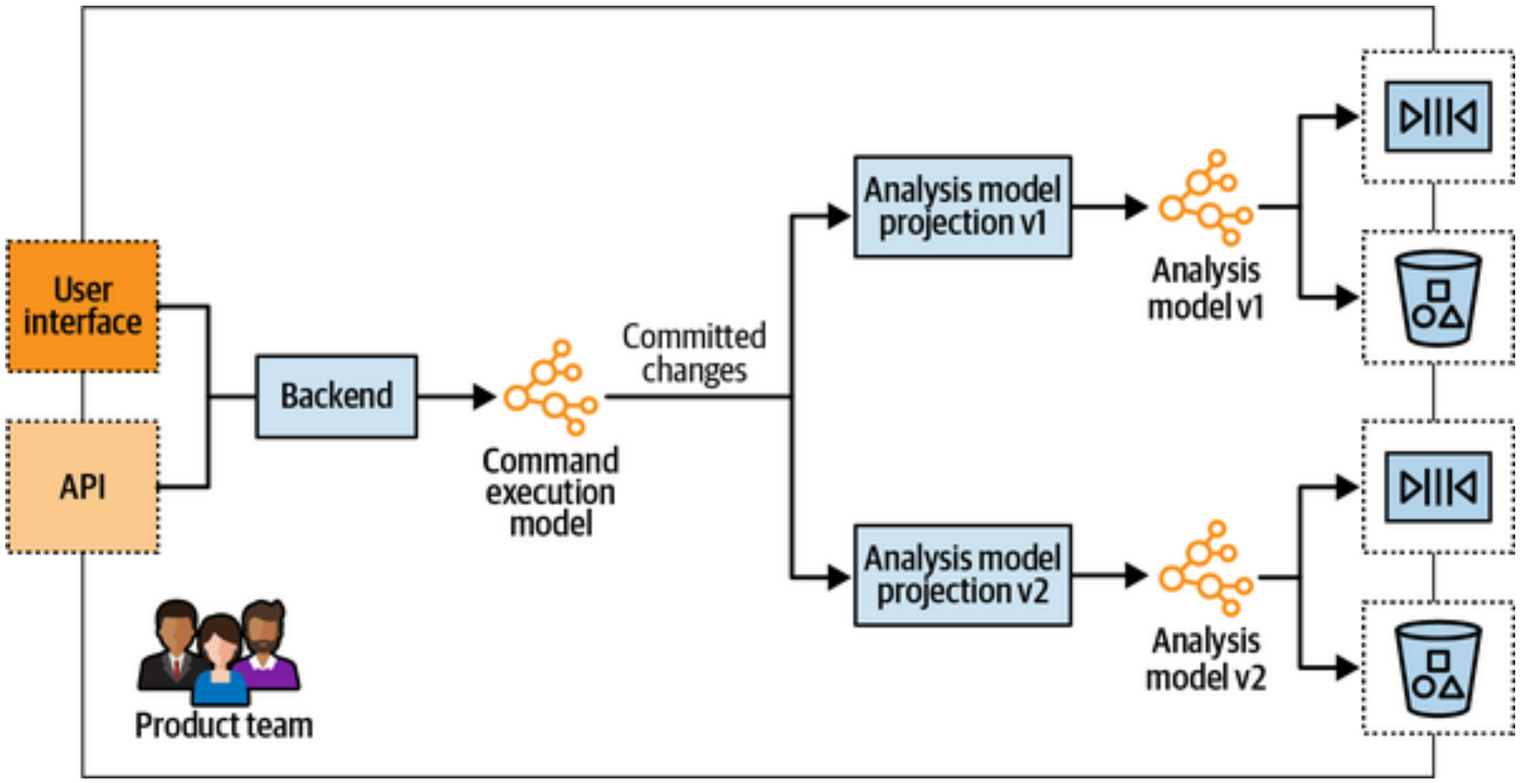
The Diagram


Marketing bounded context
User interface
API
Backend
Operational data
ETL
Marketing analysis model
Marketing product team
Support bounded context
User interface
API
Backend
Operational data
ETL
Support analysis model
Support product team
Sales bounded context
User interface
API
Backend
Operational data
ETL
Sales analysis model
Sales product team

Federated Governance



Having different models of the data



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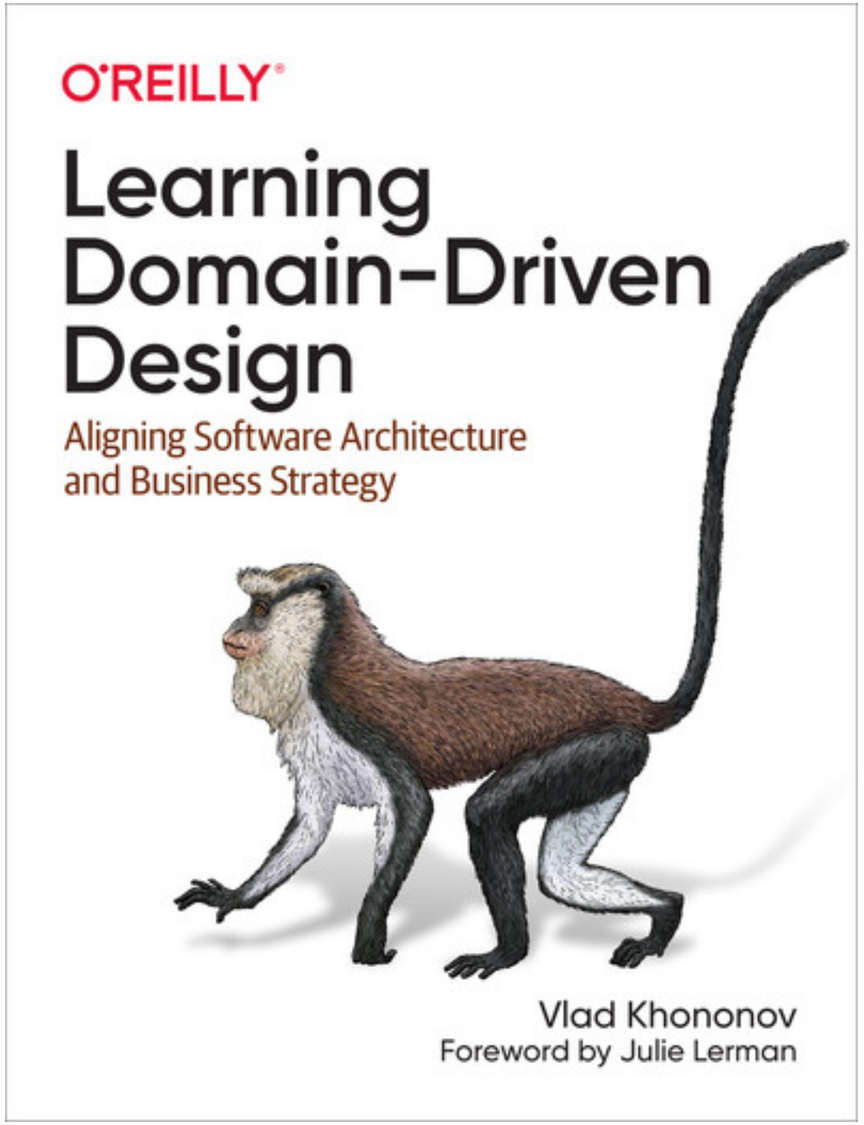

TIME TO COMPLETE:
8h 32m
LEVEL:
Intermediate to advanced
SKILLS:
Domain-Driven Design
PUBLISHED BY:
O'Reilly Media, Inc.
PUBLICATION DATE:
October 2021
PRINT LENGTH:
342 pages

Thank You

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